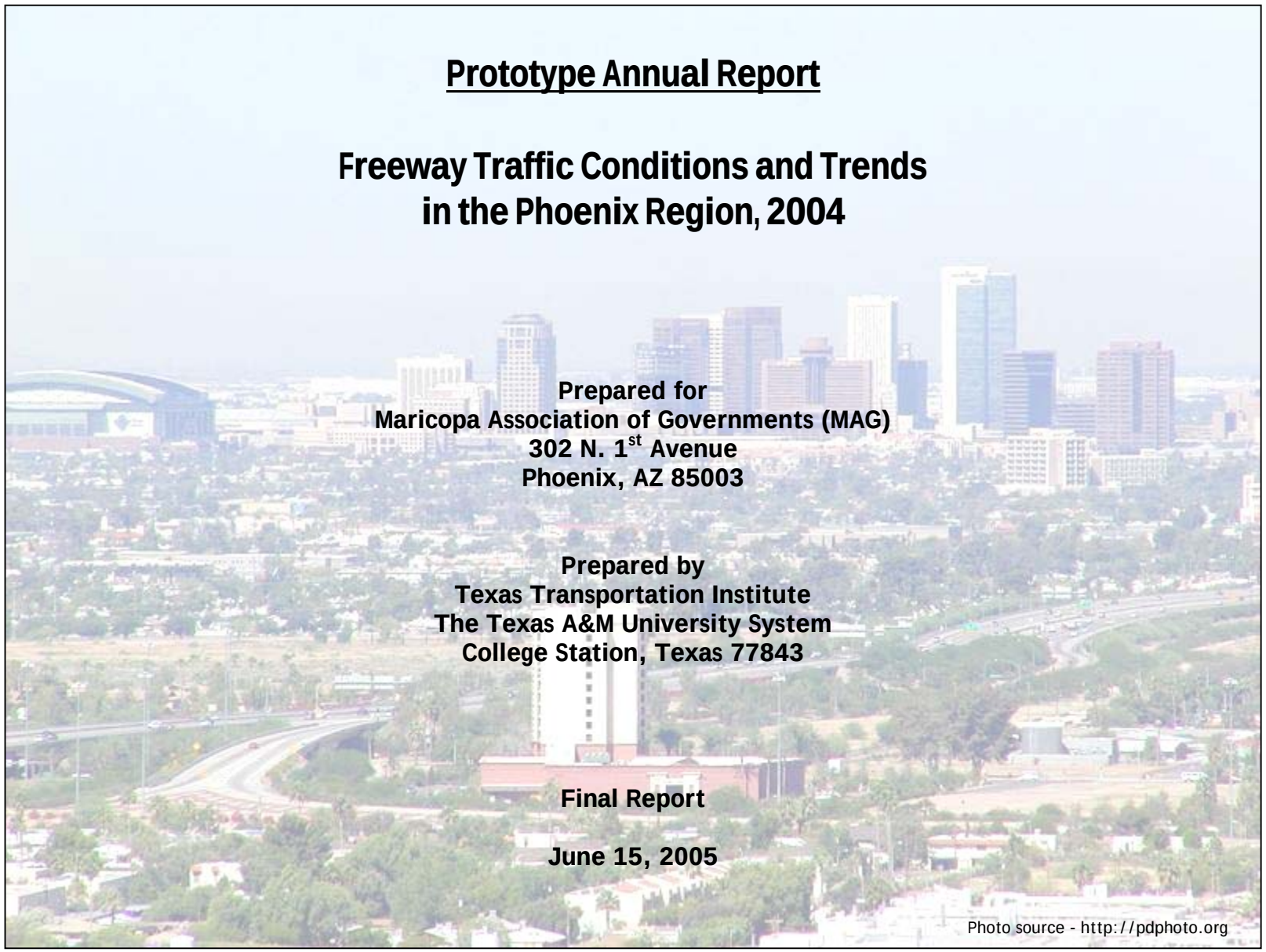
Prototype Annual Report

Freeway Traffic Conditions and Trends in the Phoenix Region, 2004



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1. INTRODUCTION

Purpose of Report

This report is the first in a series of annual reports to provide information about traffic conditions and trends at selected freeway locations in the Phoenix metropolitan area. The primary purpose of this report series is to provide information to decision makers about key policy issues such as traffic congestion, peak traffic spreading, and traffic growth.

The information in this report also can be used by the Maricopa Association of Governments (MAG), the Arizona Department of Transportation (ADOT), and other agencies in the Phoenix area to:

1. Target and prioritize funding for freeway improvements;
2. Manage freeway and HOV lane operations;
3. Calibrate and/or validate computer-based travel demand and traffic simulation models; and,
4. Inform long-range transportation planning decisions

Report Topics

The topics addressed in this report include:

Freeway performance

- Timing and characteristics of peak traffic hours
- Extent and duration of traffic congestion
- Average congestion statistics for different time periods
- Average traffic volumes and speeds by time of day
- Typical traffic patterns by lane at selected locations

Traffic characteristics

- Average annual, weekday, and weekend traffic volumes
- Truck traffic volumes
- Peak hour and directional distribution factors

Overview of Report

This report contains the following major sections:

1. **Introduction:** outlines the purpose and contents of the report;

2. **Traffic Monitoring System:** documents the freeway sensor system that gathered the data analyzed in the report;

3. **Freeway Performance:** includes maps, charts, and tables that characterize the extent, duration, and growth of freeway traffic congestion;

4. **Traffic Characteristics:** includes maps, charts, and tables that summarize traffic patterns and characteristics;

5. **Findings and Conclusions:** summarizes the major findings of the analysis; and,

Appendix: contains charts of freeway performance and traffic characteristics for specific freeway locations.

2. TRAFFIC MONITORING SYSTEM

Traffic Sensors

The traffic data included in this report were collected by the Traffic Monitoring System (TMS), which consists of traffic sensors at 58 sites on 7 different freeways in the Phoenix region (Table A-1 in the Appendix). At each of these 58 sites, inductance loop detectors or passive acoustic detectors are used to collect traffic data for all freeway lanes in a given direction. Freeway entrance ramps also are monitored at 54 of the 58 sites, as the freeway mainlane sensors are located just prior to the freeway ramp merge area. Each of the 58 sites can be paired with a site in the opposite traffic direction to create 29 virtual locations at which traffic characteristics can be represented for all lanes in both freeway directions.

The traffic sensors in the TMS are a subset of all traffic sensors maintained by ADOT's Freeway Management System (FMS) (Figure 1). At the beginning of 2004, the ADOT FMS sensor system included 519 sites that covered 86.5 centerline-miles of freeway in the Phoenix region. The FMS sensors are nominally spaced about 1/3-mile along most congested freeways. Limited resources have prevented the maintenance of the entire 519-site sensor system to the desired data quality level; thus, 58 of the sensor sites were selected for priority maintenance and inclusion in the TMS. These 58 TMS sites were selected such that they are located about every 3 miles on the monitored freeways. Since the selection of these 58 TMS sites in 2004, ADOT has decided to decommission some of the remaining FMS sensors, effectively leaving FMS traffic sensors spaced at about 1-mile intervals on the monitored freeway network. The 58 sites selected for TMS will continue to receive priority maintenance to ensure they provide data for traffic monitoring and annual reporting purposes.

Traffic Data

The ADOT FMS collects the traffic sensor data and makes it available to the general public through a traveler information portal (ftp://az511.com/pub/traffic/). The traffic data is available at several different levels of detail (i.e., 5-minute, 15-minute, 60-minute, 24-hour) and may be downloaded the day after collection. The data files include a variety of sensor data and metadata for each lane that is monitored; however, the primary data used for this report include the following:

- Traffic volume: total number of vehicles counted
- Lane occupancy: percent of time the detector sensed traffic in a detection zone (%)
- Traffic speed: average vehicle speed (mph)
- Truck 1 volume: number of trucks counted with a length between 30 and 55 ft.
- Truck 2 volume: number of trucks counted with a length greater than 55 ft.

Quality Control and Data Analysis

The analysis performed for this report began with 5-minute lane-by-lane data (the most detailed available). Additional quality control checks were used to identify questionable or suspect data (Table A-2 in the Appendix). The 5-minute data were then summarized to 15-minute lane-by-lane data. All analyses in this report were derived from this basic 2004 data set. Historical data from 2000 through 2003 were also analyzed used these same procedures.

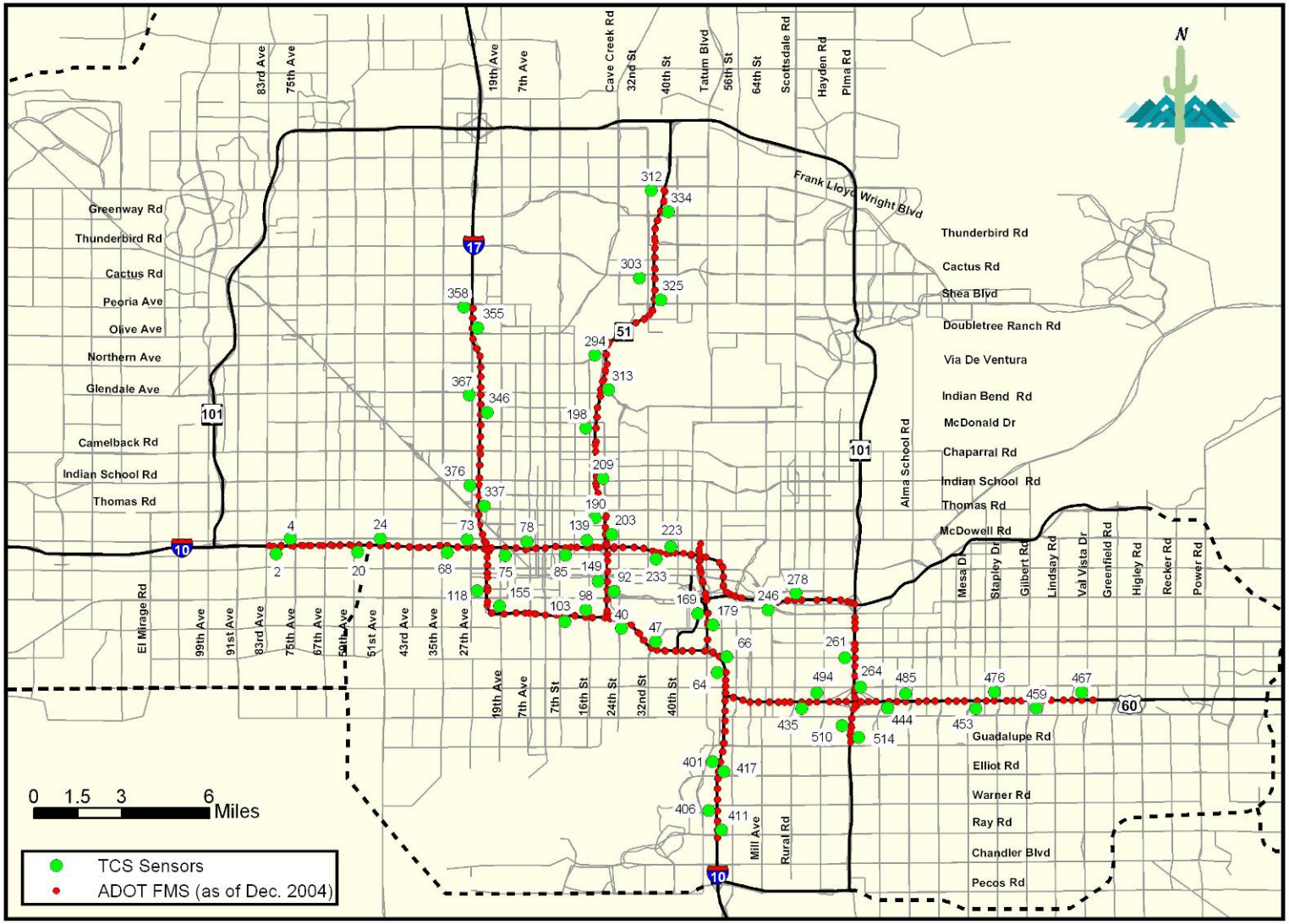

Figure 1. Location of TMS Sensors (Station # shown) with Respect to ADOT FMS Sensors

Traffic Data Quality

In summarizing the original source data (5-minute lane-by-lane), it was evident that there were periodic sensor outages and other events that caused data to be missing at various dates and times. A limited amount of imputation was used to estimate missing values for small time intervals, and annual averages were based on the number of available days during the year. These periodic outages and missing data were not considered to be significant for annual reporting purposes. However, the outages and missing data could be significant for other applications that require comprehensive data for a specific day or a specific time.

There were several locations where one or more freeway lanes had no data for the entire year of 2004:

- STN 73, I-10 WB: W of 27th Ave: Missing lanes 3,4,5
- STN 139, I-10 WB: W of 16th St: Missing inside freeway/HOV lane
- STN 312: SR 51: S of Bell, Missing lanes 1,2,3 (all lanes)

There were also numerous locations where the associated entrance ramp had no data for the entire year of 2004:

- STN 20, I-10 EB: E of 59th Ave
- STN 68, I-10 EB: E of 35th Ave
- STN 75, I-10 EB: E of 19th Ave
- STN 64, I-10 EB: E of 48th St
- STN 417, I-10 WB: N of Elliot
- STN 411, I-10 WB: S of Elliot
- STN 355, I-17 NB: N of Dunlap
- STN 303, SR 51 SB: S of Cactus
- STN 312, SR 51 SB: S of Bell

3. FREEWAY PERFORMANCE

This chapter includes maps, charts, and tables that characterize the extent, duration, and growth of freeway traffic congestion at the 58 TMS sites. The topics addressed in this chapter include:

- Timing and characteristics of peak traffic hours
- Extent and duration of traffic congestion
- Average congestion statistics for different time periods
- Average traffic volumes and speeds by time of day
- Typical traffic patterns by lane at selected locations

Analysis Parameters and Procedures

There are numerous parameters and procedures used to summarize and calculate the performance measures shown in this chapter. The following paragraphs document these parameters and procedures.

- **Average weekday statistics** do not include weekend days or Federal and Arizona State holidays.

- **All average speed calculations** are weighted by vehicle volumes for that particular speed. The average speeds presented in this report are all time-mean speeds at a specific TMS site.

- **Limited imputation is used** to account for missing traffic volume data. The imputation procedure assumes that, if missing data exists for short time periods (15 minutes or less), the total vehicle volume can be calculated from the average vehicle flow rate during the time of partially missing data samples.

- **Data from auxiliary lanes** are not included in any statistics. The freeway sensor locations are typically located just upstream of entrance ramp merge areas and therefore auxiliary lanes are not present.

- **The time of the peak hour** was calculated using two different methods: 1) the single hour during the day in which average weekday traffic volumes are the highest; and 2) the single hour during the day in which average weekday travel speeds are lowest. The peak hour times are calculated for each TMS site (by freeway and direction) and are based on speeds and volumes in the freeway general purpose lanes (not including HOV lanes). A single peak hour is calculated for the entire day.

- **The time of the peak periods** was designated as 6 to 9 am and 3 to 7 pm for average weekday statistics. An "extended AM period" was defined as 5 to 10 am and an "extended PM period" was defined 2 to 7 pm. The peak period and extended period times are fixed and identical for all 58 TMS sites.

- **Congestion and delay** is assumed to occur at speeds less than 50 mph. Severe congestion is assumed to occur at speeds less than 35 mph.

- **Free-flow speeds are estimated** by using the 85th percentile speed from all days and times during the year.

- **Vehicle-miles of travel (VMT) calculations** are based on an associated link length for each of the point sensor locations. The link length is estimated by assuming that

each sensor has a zone of influence equal to half the distance to the sensors immediately upstream and downstream. The measured volumes and speeds were then assumed to be constant within this zone of influence. The estimated link lengths range from 1.7 to 4.9 miles.

- **Nearly all trend analyses are shown comparing 2004 to 2003 conditions.** The year 2003 was chosen because numerous TMS sites were activated during this year; thus, trend data for these new sites would not be available prior to 2003. Future trend analyses will encompass several years.

Duration of Congestion

Congestion has been defined as "the travel time or delay in excess of that normally incurred under light or free-flow travel conditions."[1] For the purposes of this report, congestion is defined to occur when freeway users are unable to travel at least 50 mph. Severe congestion is defined to occur when freeway users are unable to travel at least 35 mph.

Congestion can be quantified in four different dimensions:

1. Severity/intensity: The average or maximum level of delay;
2. Extent: The quantity of travelers or roadways that experience delay;
3. Duration: The length of time during which delay occurs.
4. Reliability/variability: The frequency with which delay occurs over a specified time period.

[1] *NCHRP Report 398: Quantifying Congestion*. Volume 1, Final Report. Transportation Research Board, 1997.

The duration of congestion has been used in the Phoenix area as a congestion measure. In this report, congestion duration is reported as the actual duration of time (in hours) in congestion. The following maps showing congestion duration are presented in this section:

- Hours of congestion in the morning (5a-10a): Figure 2
- Hours of congestion in the evening (2p-7p): Figure 3
- Hours of severe congestion in the morning (5a-10a): Figure 4
- Hours of severe congestion in the evening (2p-7p): Figure 5

The duration of congestion was also calculated for the years 2000 through 2003. If peak traffic spreading has occurred in Phoenix, then the congestion duration values should increase over time. Figure 6 shows the change in morning congestion duration from 2003 to 2004. Figure 7 shows the change in evening congestion duration from 2003 to 2004.

Figure 8 shows the changes in total congestion duration (morning and evening) from 2000 through 2004. Because the number of data collection sites has increased over this time period, a measure of traffic intensity (VMT per lane-mile) is also shown. Figure 8 shows that the total congestion duration dropped sharply from 74 minutes in 2000 to 49 minutes in 2002. This large increase corresponded to a leveling of traffic in 2003. Between 2002 and 2004, though, congestion duration increased from 49 to 58 minutes, which a large jump in traffic between 2003 and 2004.

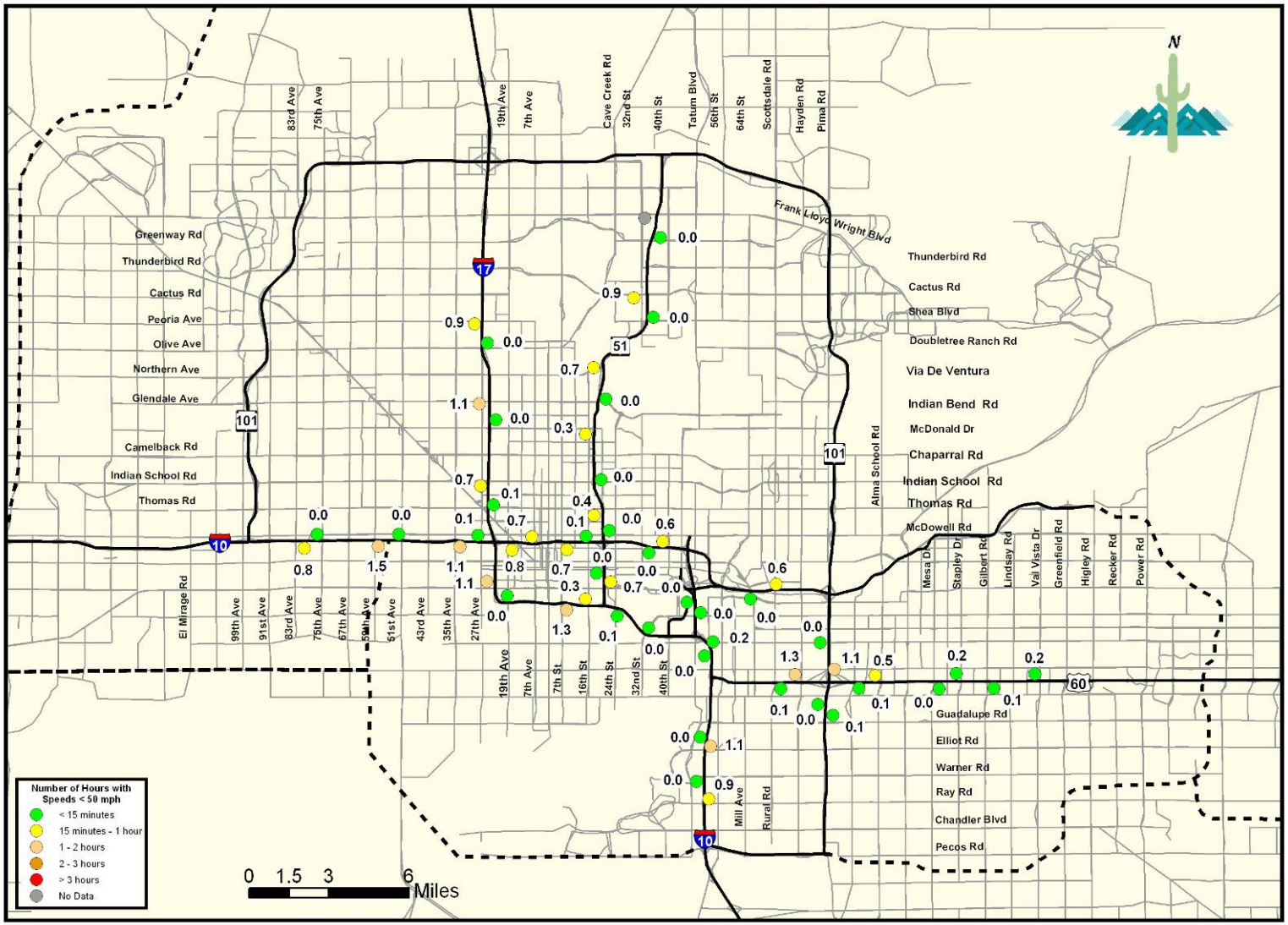

Figure 2. Hours of Congestion in the Morning (5a-10a), 2004

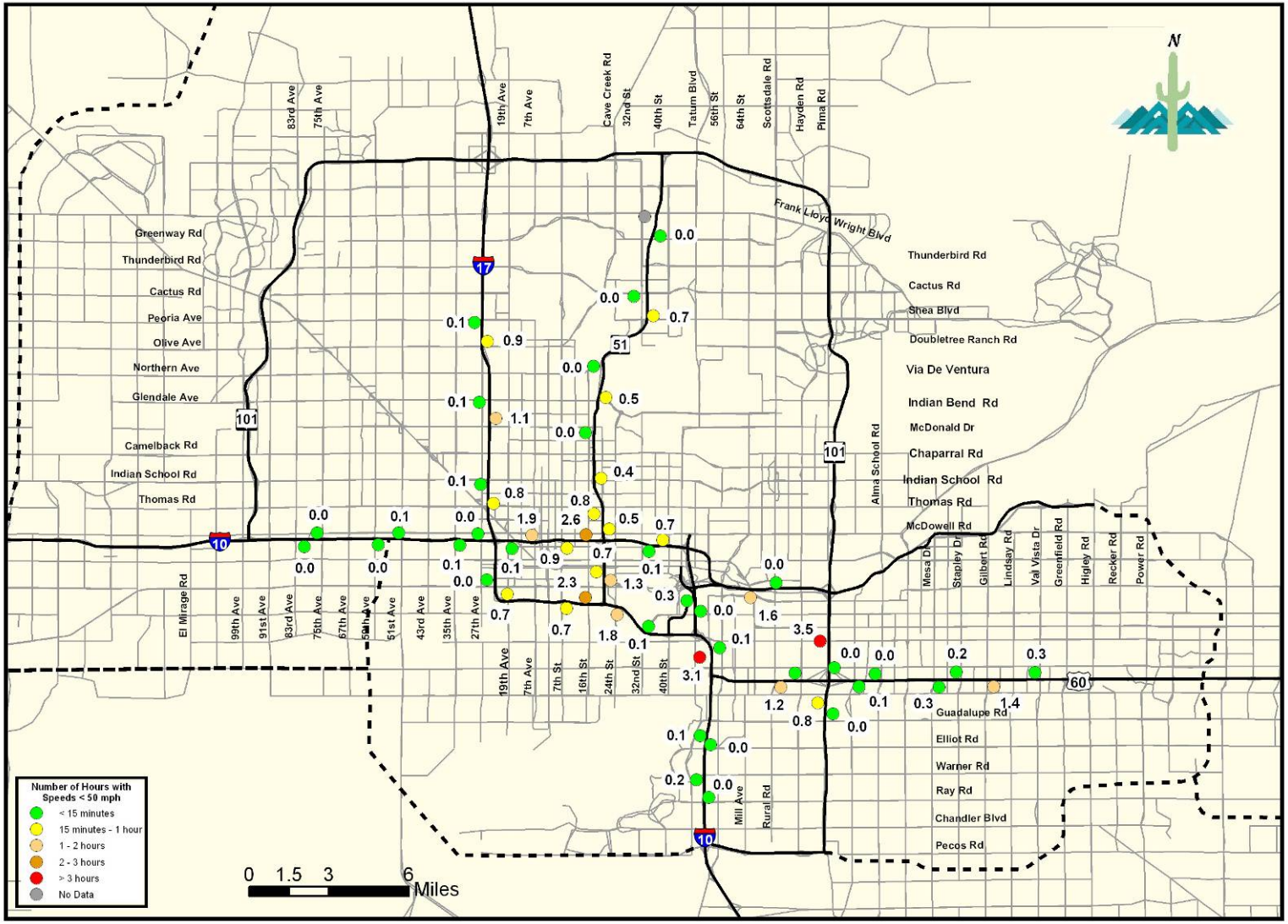

Figure 3. Hours of Congestion in the Evening (2p-7p), 2004

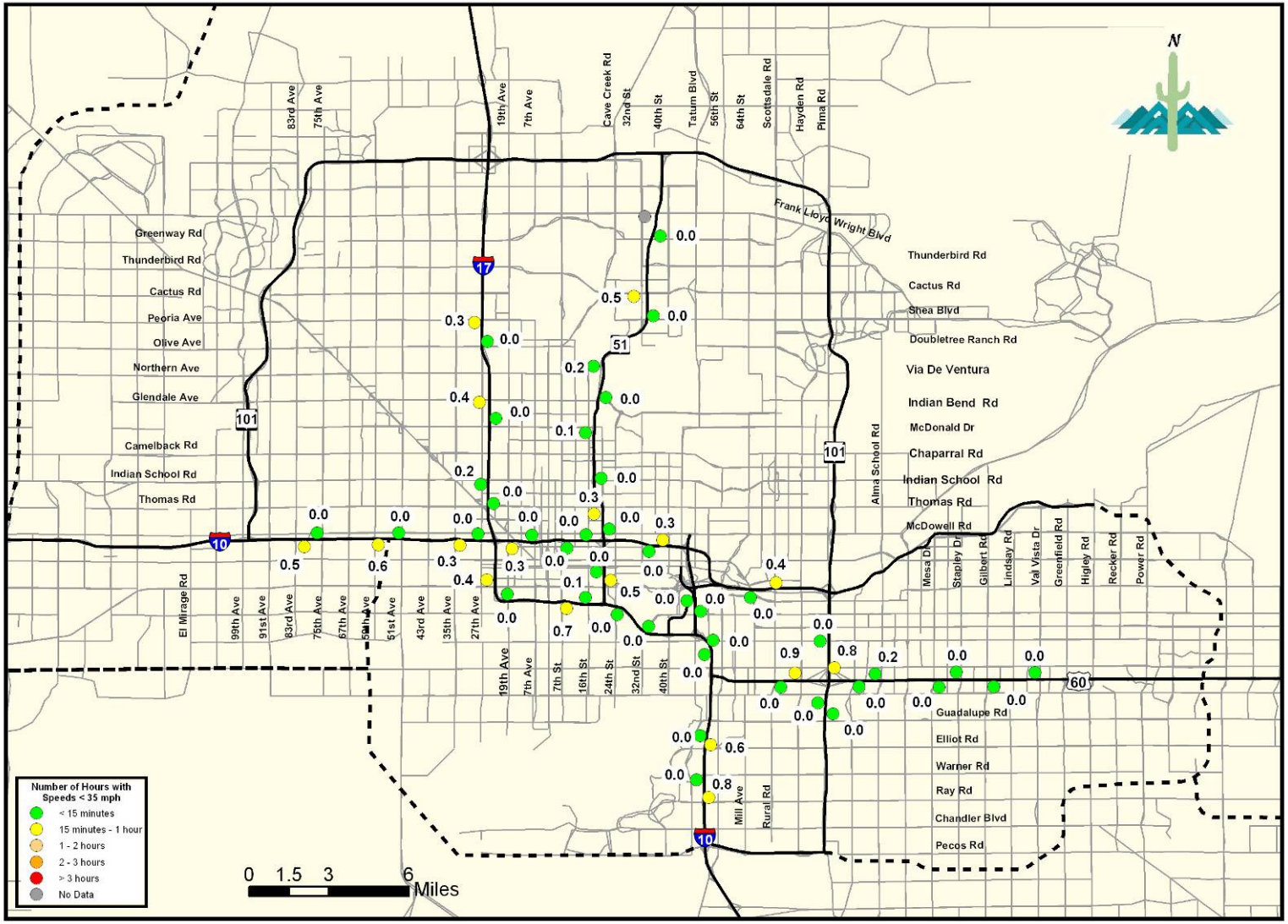

Figure 4. Hours of Severe Congestion in the Morning (5a-10a), 2004

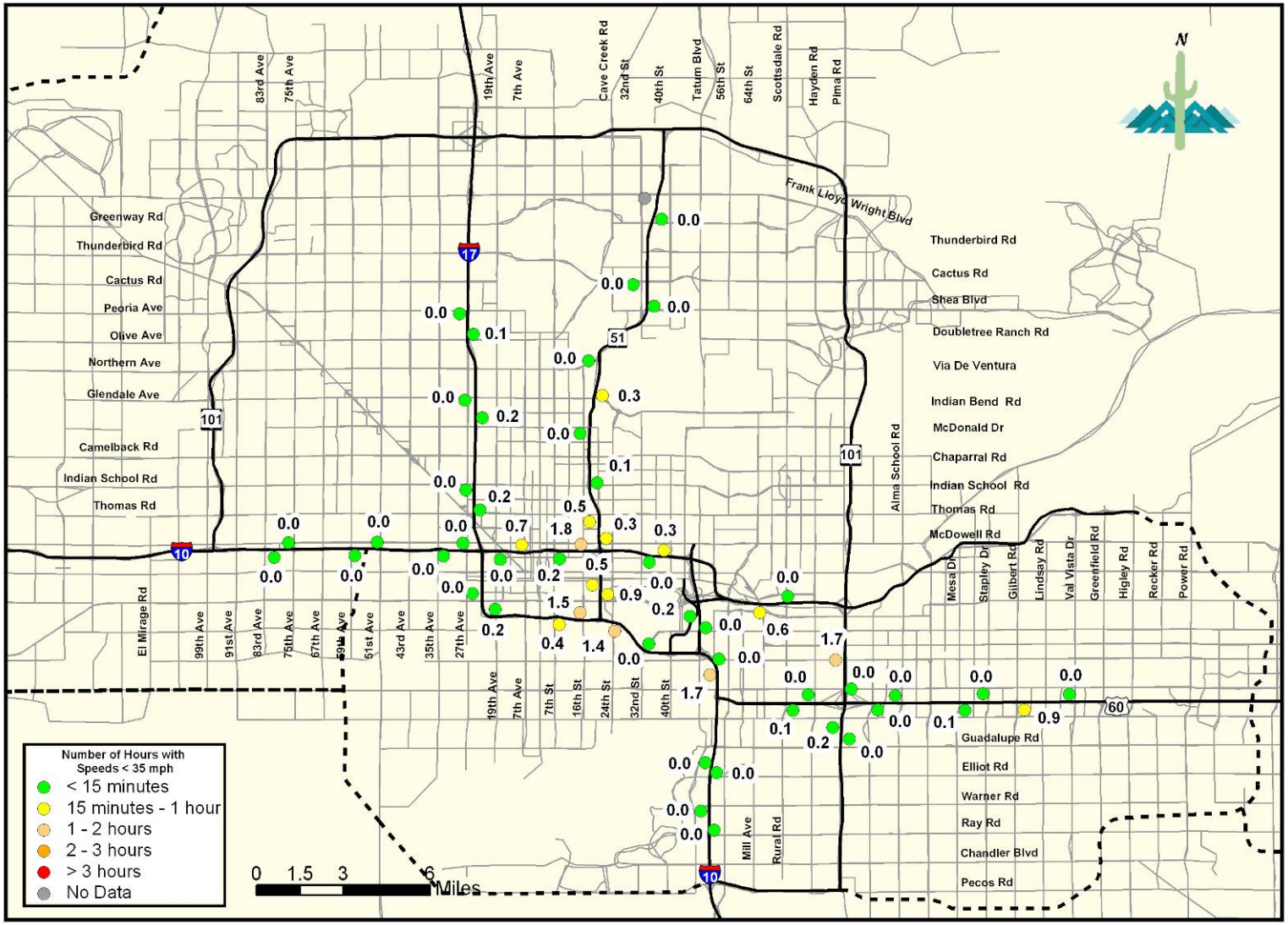

Figure 5. Hours of Severe Congestion in the Evening (2p-7p), 2004

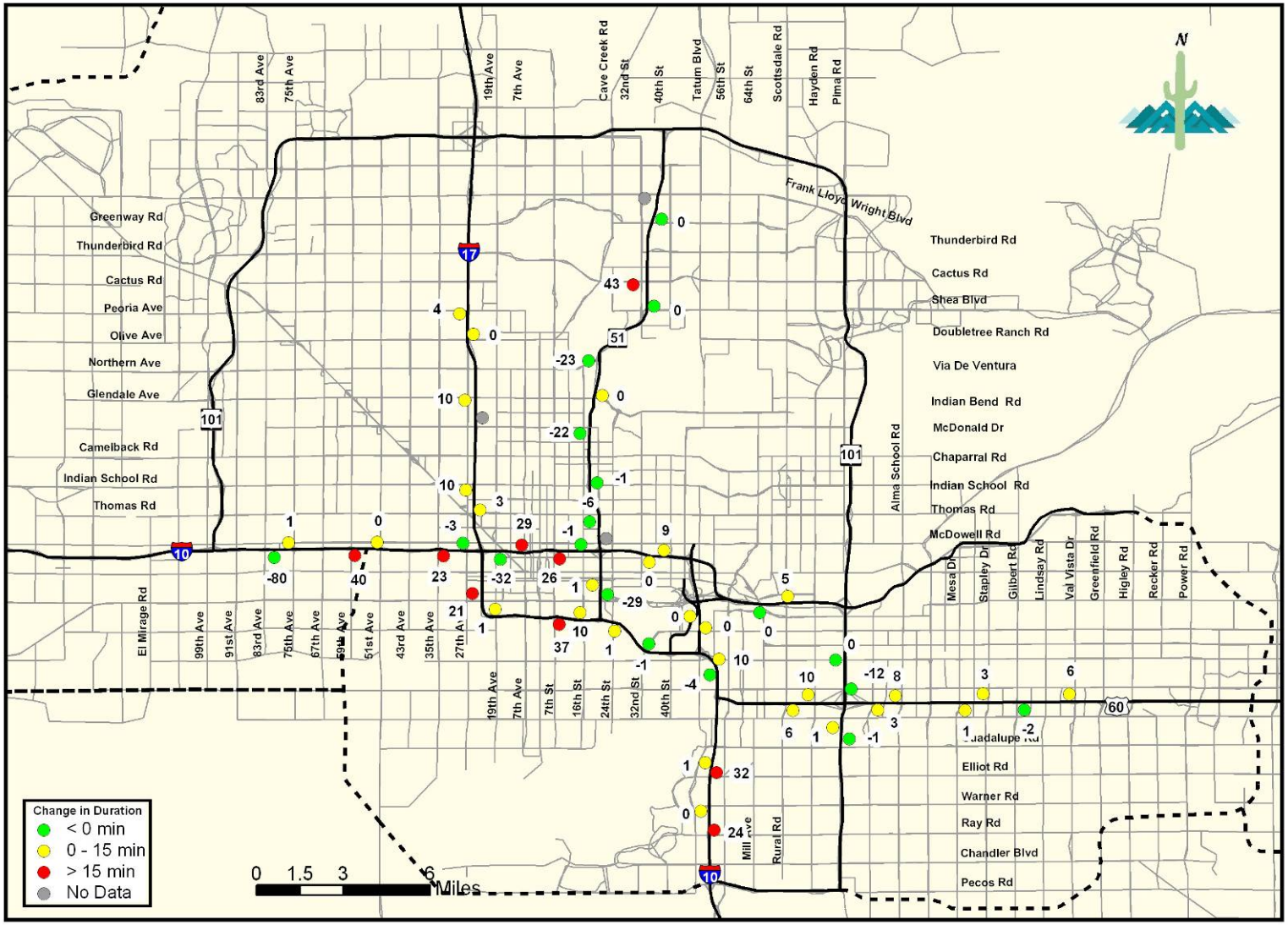

Figure 6. Change in Morning (5a-10a) Congestion Duration (minutes), 2003 to 2004

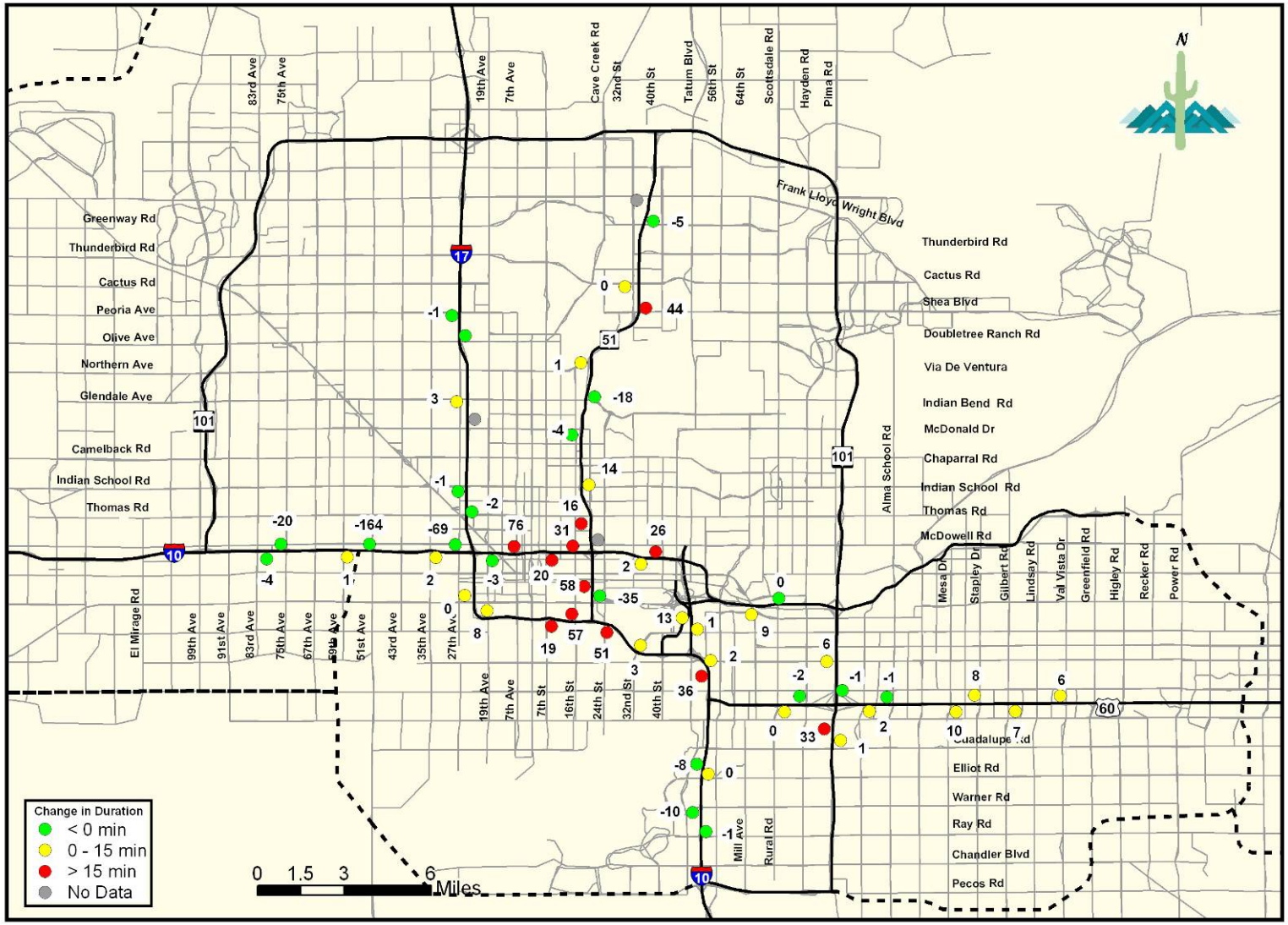

Figure 7. Change in Evening (2p-7p) Congestion Duration (minutes), 2003 to 2004

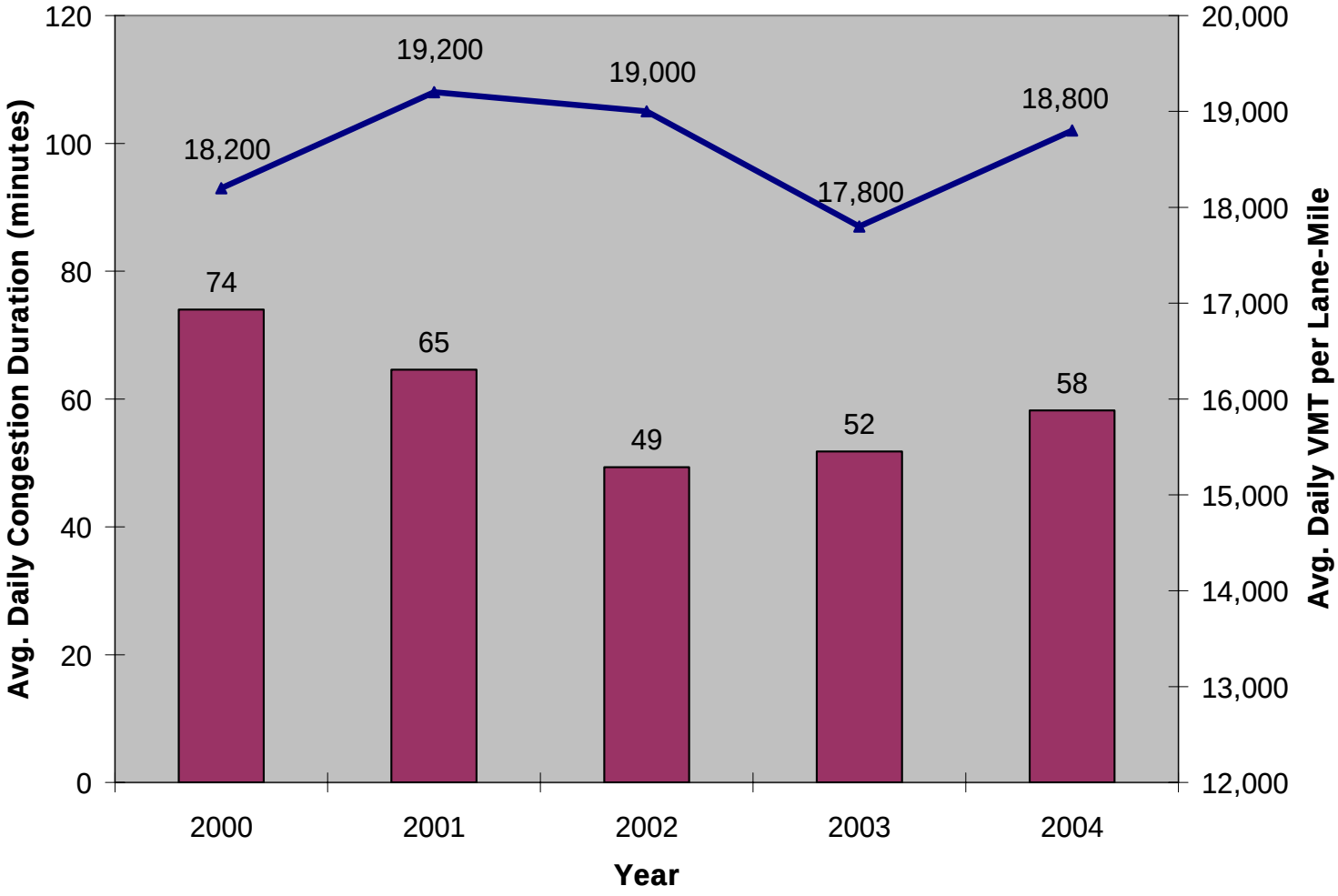

Figure 8. Trends in Total Daily (5a-10a, 2p-7p) Duration of Congestion, 2000 to 2004

Peak Hour Statistics

As described earlier, the time of the peak hour was calculated for each TMS site using two different approaches: 1) the hour of highest traffic volumes; and 2) the hour of lowest travel speeds. The first method is recommended by the 2000 *Highway Capacity Manual* (HCM) for the purposes of evaluating freeway segments.

Readers should note that these two approaches do not provide the same peak hour time for congested freeway segments. When vehicle demand exceeds capacity (i.e., congestion occurs), the unstable traffic flow occurs at lower vehicle flow rates and lower speeds. Thus, the hour of highest traffic volumes typically occurs before the onset of congestion, when traffic flow has not yet become unstable. The hour of lowest travel speeds typically occurs sometime after the hour of highest volumes, and the vehicle flow rates during this speed-based peak hour can be much lower than the highest flow rates during the day. Ultimately, the method used to calculate peak hour statistics depends upon the particular application.

Tables 1 and 2 illustrate the differences between a peak hour of highest volumes and a peak hour of lowest speeds. Table 1 includes peak hour statistics for the hour of highest traffic volumes. Table 2 includes peak hour statistics for the hour of lowest travel speeds.

Figure 9 shows a map of average peak hour speeds for the hour of highest traffic volumes. Figure 10 shows a map of average peak hour speeds for the hour of lowest travel speeds.

The following additional traffic and congestion statistics were computed for the peak hour for the freeway general purpose and HOV lanes:

- Average flow rate (vehicle per hour per lane);
- Average peak hour vehicle-miles of travel (VMT);
- Average speed (mph); and
- Total annual peak hour weekday delay (vehicle-hours).

These traffic and congestion statistics are included in Table 3 for the peak hour based on highest traffic volume. The same traffic and congestion statistics are included in Table 4 for the peak hour based on lowest travel speed.

Table 1. Average Weekday Peak Hour Speeds and Volumes by Lane, 2004 (peak hour based on highest traffic volumes)

Location	Peak		Northbound/Eastbound Direction							Location	Peak		Southbound/Westbound Direction							
NB/EB STN #	Hour	Data	ENT	GP 5	GP 4	GP 3	GP 2	GP 1	HOV	SB/WB STN #	Hour	Data	HOV	GP 1	GP 2	GP 3	GP 4	GP 5	GP 6	ENT
I-10 EB: E of 83rd Ave	5:45 A	Spd		52	50	52	52	61	68	I-10 WB: W of 75th Ave	4:30 P	Spd	66	67	64	63	64			
2	6:45 A	Vol	749	655	1,069	1,090	1,175	1,658	974	4	5:30 P	Vol	1,144	1,799	1,061	186	1,355			441
I-10 EB: E of 59th Ave	5:45 A	Spd			48	50	54	58	58	I-10 WB: W of 51st Ave	4:30 P	Spd	60	58	60	61	56			
20	6:45 A	Vol	NA		921	1,128	1,087	1,283	991	24	5:30 P	Vol	1,207	1,837	1,570	1,505	1,407			578
I-10 EB: E of 35th Ave	5:45 A	Spd			53	44	44	52	59	I-10 WB: W of 27th Ave	3:30 P	Spd	62	57	57	NA	NA	NA		
68	6:45 A	Vol	NA		1,405	1,511	1,504	1,487	1,188	73	4:30 P	Vol	1,783	1,647	1,385	NA	NA	NA		577
I-10 EB: E of 19th Ave	7:00 A	Spd		43	42	45	44	56	56	I-10 WB: W of 7th Ave	2:00 P	Spd	58	56	53	52	56			
75	8:00 A	Vol	NA	1,110	1,746	1,451	1,379	1,485	1,601	78	3:00 P	Vol	1,156	1,706	1,926	1,791	1,885			997
I-10 EB: E of 7th St	6:45 A	Spd			42	47	52	55	57	I-10 WB: W of 16th St	2:00 P	Spd	NA	55	56	51	53	52	50	
85	7:45 A	Vol	NA		1,990	1,781	1,696	1,894	1,320	139	3:00 P	Vol	NA	1,954	1,723	1,573	1,623	1,734	1,152	432
I-10 EB: S of Van Buren	5:00 A	Spd				56	66	64	66	I-10 WB: N of Buckeye	7:15 A	Spd	60	48	59	57				
149	6:00 A	Vol	187			1,502	1,014	1,271	671	92	8:15 A	Vol	1,413	1,194	1,403	1,921				557
I-10 EB: E of 24th St	3:00 P	Spd		53	57	56	57	59	63	I-10 WB: W of 32nd St	7:00 A	Spd	65	64	70	66	57	54		
40	4:00 P	Vol	586	1,287	1,544	1,569	1,663	1,925	944	47	8:00 A	Vol	1,169	1,989	1,449	1,641	1,698	1,258		772
I-10 EB: E of 48th St	3:00 P	Spd		33	33	37	45	46	50	I-10 WB: N of Southern Ave	6:15 A	Spd	61	60	60	54	56	62		
64	4:00 P	Vol	NA	1,498	1,558	1,750	1,638	2,024	1,399	66	7:15 A	Vol	1,427	2,432	2,175	1,839	2,360	1,907		
I-10 EB: S of Guadalupe	4:45 P	Spd			57	51	61	59	65	I-10 WB: N of Elliot	6:15 A	Spd	59	54	51	46				
401	5:45 P	Vol			1,636	1,960	1,987	2,254	938	417	7:15 A	Vol	958	1,963	1,844	1,812				NA
I-10 EB: S of Warner	4:45 P	Spd				48	54	59	63	I-10 WB: S of Elliot	6:00 A	Spd	67	55	52	46				
406	5:45 P	Vol	608			2,222	1,822	1,907	736	411	7:00 A	Vol	563	1,682	1,499	1,274				NA
I-17 NB: 16th St	7:00 A	Spd				50	56	59		I-17 SB: E of 7th St	7:00 A	Spd		46	42	41				
98	8:00 A	Vol	382			1,626	1,537	1,690		103	8:00 A	Vol		1,825	1,336	1,182				84
I-17 NB: N of Buckeye	3:30 P	Spd				50	52	52		I-17 SB: S of Van Buren	5:45 A	Spd		54	47	47				
155	4:30 P	Vol				1,443	1,676	1,852		118	6:45 A	Vol		1,780	1,555	1,466				285
I-17 NB: N of Thomas	2:45 P	Spd				53	51	55	63	I-17 SB: S of Indian School	6:30 A	Spd	61	53	49	46				
337	3:45 P	Vol	322			1,318	1,531	1,679	739	376	7:30 A	Vol	658	1,863	1,666	1,502				742
I-17 NB: S of Glendale	2:30 P	Spd				51	60	57	64	I-17 SB: S of Glendale	3:30 P	Spd	65	60	58	49				
346	3:30 P	Vol	372			1,441	1,638	1,680	1,074	367	4:30 P	Vol	633	1,815	1,598	1,397				310
I-17 NB: N of Dunlap	3:15 P	Spd				52	54	57	64	I-17 SB: S of Peoria	6:00 A	Spd	59	50	53	51				
355	4:15 P	Vol	NA			1,594	1,444	1,744	776	358	7:00 A	Vol	805	1,819	1,543	1,264				358

Table abbreviations: NB = northbound; EB = Eastbound; SB = southbound; WB = westbound; STN = station; ENT= entrance ramp; GP = general purpose (freeway mainlanes); HOV = high-occupancy vehicle; Spd = Speed; Vol = Volume; NA = No data available

Table 1 continued on next page

Table 1. Average Weekday Peak Hour Speeds and Volumes by Lane, 2004 (Continued)
(peak hour based on highest traffic volumes)

Location	Peak		Northbound/Eastbound Direction							Location	Peak		Southbound/Westbound Direction							
NB/EB STN #	Hour	Data	ENT	GP 5	GP 4	GP 3	GP 2	GP 1	HOV	SB/WB STN #	Hour	Data	HOV	GP 1	GP 2	GP 3	GP 4	GP 5	GP 6	ENT
Loop 101 NB: N of Southern	6:15 A	Spd		48	45	47	46	53		Loop 101 SB: S of Broadway	4:00 P	Spd		41	42	33	33			
264	7:15 A	Vol	547	1,156	1,451	1,709	1,567	1,800		261	5:00 P	Vol		2,063	1,734	1,894	1,836			960
Loop 101 NB: N of Guadalupe	6:30 A	Spd			70	69	59	54		Loop 101 SB: S of Baseline	4:45 P	Spd		48	52	49	53			
514	7:30 A	Vol			1,225	1,407	1,739	2,119		510	5:45 P	Vol		2,036	1,881	1,642	1,327			751
Loop 202 EB: E of 32nd St	4:30 P	Spd				55	57	59	62	Loop 202 WB: W of 40th St	7:00 A	Spd	59	49	49	48	50			
233	5:30 P	Vol	744			2,023	1,954	2,044	933	223	8:00 A	Vol	740	1,869	1,686	1,596	1,076			509
Loop 202 EB: W of Priest	3:15 P	Spd			47	53	49	53	56	Loop 202 WB: W of Scottsdale	6:15 A	Spd	63	54	52	52	54			
246	4:15 P	Vol	124		1,576	1,769	1,794	1,951	919	278	7:15 A	Vol	768	2,270	1,924	1,842	1,638			121
SR 143 NB: N of University	7:15 A	Spd					59	62		SR 143 SB: S of Washington	7:15 A	Spd		67	63	56				
179	8:15 A	Vol	124				1,988	1,509		169	8:15 A	Vol		894	1,303	1,533				
SR 51 NB: N of McDowell	3:15 P	Spd			63	61	63	63	67	SR 51 SB: S of Thomas	6:30 A	Spd	63	60	61	59				
203	4:15 P	Vol	618		800	1,556	1,459	1,613	431	190	7:30 A	Vol	462	1,764	1,405	1,919				489
SR 51 NB: N of Indian School	3:30 P	Spd				62	61	66	66	SR 51 SB: S of Bethany	6:30 A	Spd	60	59	53	53				
209	4:30 P	Vol	1,083			1,539	1,644	1,961	694	198	7:30 A	Vol	703	2,027	1,833	1,670				566
SR 51 NB: N of Glendale	3:45 P	Spd				61	64	66	66	SR 51 SB: S of Northern	6:30 A	Spd	69	64	60	59	60			
313	4:45 P	Vol	1,389			1,821	1,832	1,543	694	294	7:30 A	Vol	628	1,264	1,164	1,006	976			415
SR 51 NB: N of Shea	4:45 P	Spd				51	54	51		SR 51 SB: S of Cactus	6:30 A	Spd		54	52	50				
325	5:45 P	Vol	726			2,081	1,989	1,827		303	7:30 A	Vol		2,156	1,902	1,552				NA
SR 51 NB: N of Greenway	5:00 P	Spd				59	61	64		SR 51 SB: S of Bell	12:00 A	Spd		NA	NA	NA				
334	6:00 P	Vol	431			1,581	1,451	1,342		312	12:00 A	Vol		NA	NA	NA				NA
US 60 EB: E of Rural	4:00 P	Spd				36	48	59	59	US 60 WB: W of McClintock	5:45 A	Spd	61	52	59	49	48			
435	5:00 P	Vol	311			1,724	1,689	1,873	1,063	494	6:45 A	Vol	1,011	1,751	1,544	1,383	1,099			337
US 60 EB: E of Dobson	4:15 P	Spd		56	58	52	55	59	58	US 60 WB: W of Alma School	6:15 A	Spd	66	59	54	54	51	51		
444	5:15 P	Vol	771	1,579	1,677	1,492	1,699	1,908	978	485	7:15 A	Vol	872	1,765	1,563	1,819	792	750		178
US 60 EB: E of Mesa Dr	4:15 P	Spd		53	56	59	57	67	70	US 60 WB: W of Stapley	6:15 A	Spd	56	54	52	53	59	60		
453	5:15 P	Vol	502	1,703	1,543	1,417	1,486	1,665	925	476	7:15 A	Vol	714	1,822	1,626	1,610	1,456	1,164		358
US 60 EB: E of Gilbert	4:15 P	Spd			42	38	35	48	55	US 60 WB: W of Val Vista	6:00 A	Spd	56	53	53	49				
459	5:15 P	Vol	455		1,129	1,243	1,266	1,555	1,009	467	7:00 A	Vol	528	1,976	1,795	1,215				513

Table abbreviations: NB = northbound; EB = Eastbound; SB = southbound; WB = westbound; STN = station; ENT= entrance ramp; GP = general purpose (freeway mainlanes); HOV = high-occupancy vehicle; Spd = Speed; Vol = Volume; NA = No data available

Table 2. Average Weekday Peak Hour Speeds and Volumes by Lane, 2004 (peak hour based on lowest travel speeds)

Location	Peak		Northbound/Eastbound Direction							Location	Peak		Southbound/Westbound Direction							
NB/EB STN #	Hour	Data	ENT	GP 5	GP 4	GP 3	GP 2	GP 1	HOV	SB/WB STN #	Hour	Data	HOV	GP 1	GP 2	GP 3	GP 4	GP 5	GP 6	ENT
I-10 EB: E of 83rd Ave	7:00 A	Spd		43	37	39	37	46	55	I-10 WB: W of 75th Ave	5:00 A	Spd	67	68	63	64	64			
2	8:00 A	Vol	635	793	967	908	978	1,227	974	4	6:00 A	Vol	561	853	699	154	692			193
I-10 EB: E of 59th Ave	7:00 A	Spd			39	40	43	48	49	I-10 WB: W of 51st Ave	5:00 P	Spd	60	58	59	60	55			
20	8:00 A	Vol	NA		836	981	923	996	944	24	6:00 P	Vol	1,222	1,808	1,547	1,493	1,394			546
I-10 EB: E of 35th Ave	7:15 A	Spd			49	40	39	48	56	I-10 WB: W of 27th Ave	5:15 A	Spd	62	53	55	NA	NA	NA		
68	8:15 A	Vol	NA		1,349	1,490	1,475	1,414	1,199	73	6:15 A	Vol	517	612	601	NA	NA	NA		248
I-10 EB: E of 19th Ave	7:15 A	Spd		43	41	44	43	56	56	I-10 WB: W of 7th Ave	4:45 P	Spd	44	35	32	33	39			
75	8:15 A	Vol	NA	1,122	1,722	1,456	1,388	1,480	1,588	78	5:45 P	Vol	1,048	1,521	1,765	1,696	1,743			1,000
I-10 EB: E of 7th St	7:15 A	Spd			41	46	51	55	57	I-10 WB: W of 16th St	4:45 P	Spd	NA	37	38	36	38	38	34	
85	8:15 A	Vol	NA		1,963	1,777	1,673	1,838	1,253	139	5:45 P	Vol	NA	1,225	1,311	1,203	1,288	1,372	1,160	389
I-10 EB: S of Van Buren	4:45 P	Spd				44	41	44	47	I-10 WB: N of Buckeye	3:45 P	Spd	62	53	57	58				
149	5:45 P	Vol	495			1,506	912	1,164	726	92	4:45 P	Vol	1,165	957	1,229	1,834				748
I-10 EB: E of 24th St	4:45 P	Spd		28	29	28	27	28	32	I-10 WB: W of 32nd St	3:45 P	Spd	66	63	69	65	55	53		
40	5:45 P	Vol	462	1,061	1,188	1,216	1,133	1,225	1,188	47	4:45 P	Vol	851	1,745	1,300	1,533	1,493	1,028		1,427
I-10 EB: E of 48th St	5:00 P	Spd		23	21	26	32	34	41	I-10 WB: N of Southern Ave	7:00 A	Spd	57	57	57	51	53	60		
64	6:00 P	Vol	NA	1,351	1,340	1,607	1,608	1,921	1,722	66	8:00 A	Vol	1,805	2,314	2,120	1,813	2,334	1,942		
I-10 EB: S of Guadalupe	5:15 P	Spd			56	50	61	59	65	I-10 WB: N of Elliot	7:15 A	Spd	52	37	35	32				
401	6:15 P	Vol			1,612	1,934	1,941	2,195	963	417	8:15 A	Vol	1,213	1,358	1,443	1,550				NA
I-10 EB: S of Warner	5:15 P	Spd				47	53	58	62	I-10 WB: S of Elliot	7:00 A	Spd	60	34	33	30				
406	6:15 P	Vol	567			2,186	1,783	1,850	753	411	8:00 A	Vol	965	1,235	1,025	964				NA
I-17 NB: 16th St	3:30 P	Spd				35	40	42		I-17 SB: E of 7th St	7:00 A	Spd		46	42	41				
98	4:30 P	Vol	585			1,361	1,593	1,808		103	8:00 A	Vol		1,825	1,336	1,182				84
I-17 NB: N of Buckeye	4:00 P	Spd				49	52	50		I-17 SB: S of Van Buren	6:30 A	Spd		52	45	45				
155	5:00 P	Vol				1,442	1,665	1,856		118	7:30 A	Vol		1,679	1,478	1,354				296
I-17 NB: N of Thomas	4:45 P	Spd				48	44	50	61	I-17 SB: S of Indian School	5:45 A	Spd	58	54	48	46				
337	5:45 P	Vol	261			1,299	1,455	1,522	723	376	6:45 A	Vol	729	1,808	1,616	1,417				777
I-17 NB: S of Glendale	5:00 P	Spd				38	46	45	57	I-17 SB: S of Glendale	7:15 A	Spd	60	47	41	32				
346	6:00 P	Vol	354			1,385	1,494	1,528	835	367	8:15 A	Vol	522	1,479	1,431	1,355				344
I-17 NB: N of Dunlap	5:00 P	Spd				40	44	47	60	I-17 SB: S of Peoria	7:00 A	Spd	53	42	45	42				
355	6:00 P	Vol	NA			1,516	1,468	1,571	773	358	8:00 A	Vol	1,013	1,567	1,385	1,244				329

Table abbreviations: NB = northbound; EB = Eastbound; SB = southbound; WB = westbound; STN = station; ENT= entrance ramp; GP = general purpose (freeway mainlanes); HOV = high-occupancy vehicle; Spd = Speed; Vol = Volume; NA = No data available

Table 2 continued on next page

Table 2. Average Weekday Peak Hour Speeds and Volumes by Lane, 2004 (Continued)
(peak hour based on lowest travel speeds)

Location	Peak		Northbound/Eastbound Direction							Location	Peak		Southbound/Westbound Direction							
NB/EB STN #	Hour	Data	ENT	GP 5	GP 4	GP 3	GP 2	GP 1	HOV	SB/WB STN #	Hour	Data	HOV	GP 1	GP 2	GP 3	GP 4	GP 5	GP 6	ENT
Loop 101 NB: N of Southern	6:45 A	Spd		44	42	43	42	48		Loop 101 SB: S of Broadway	5:00 P	Spd		36	36	29	30			
264	7:45 A	Vol	562	1,219	1,382	1,557	1,489	1,715		261	6:00 P	Vol		1,982	1,747	1,789	1,737			980
Loop 101 NB: N of Guadalupe	7:00 A	Spd			69	69	57	52		Loop 101 SB: S of Baseline	5:00 P	Spd		46	51	48	52			
514	8:00 A	Vol			1,350	1,382	1,649	1,999		510	6:00 P	Vol		2,000	1,859	1,634	1,345			728
Loop 202 EB: E of 32nd St	4:45 P	Spd				54	57	59	62	Loop 202 WB: W of 40th St	7:30 A	Spd	57	45	44	44	47			
233	5:45 P	Vol	738			2,029	1,940	2,016	936	223	8:30 A	Vol	699	1,802	1,624	1,531	1,140			513
Loop 202 EB: W of Priest	4:45 P	Spd			35	37	34	38	48	Loop 202 WB: W of Scottsdale	7:15 A	Spd	58	42	40	39	41			
246	5:45 P	Vol	163		1,486	1,660	1,758	1,795	1,250	278	8:15 A	Vol	846	2,094	1,901	1,766	1,454			159
SR 143 NB: N of University	7:15 A	Spd					59	62		SR 143 SB: S of Washington	5:00 P	Spd		53	55	52				
179	8:15 A	Vol	124				1,988	1,509		169	6:00 P	Vol		1,157	1,230	866				
SR 51 NB: N of McDowell	4:45 P	Spd			51	43	44	46	59	SR 51 SB: S of Thomas	4:45 P	Spd	60	53	53	43				
203	5:45 P	Vol	556		891	1,188	1,112	1,098	631	190	5:45 P	Vol	476	1,296	1,138	1,298				888
SR 51 NB: N of Indian School	5:00 P	Spd				50	50	56	62	SR 51 SB: S of Bethany	7:15 A	Spd	57	55	49	50				
209	6:00 P	Vol	1,099			1,389	1,404	1,458	794	198	8:15 A	Vol	799	1,733	1,654	1,589				700
SR 51 NB: N of Glendale	5:00 P	Spd				53	58	61	64	SR 51 SB: S of Northern	7:15 A	Spd	67	54	49	48	50			
313	6:00 P	Vol	1,548			1,658	1,619	1,407	813	294	8:15 A	Vol	726	931	928	854	951			384
SR 51 NB: N of Shea	5:00 P	Spd				50	53	50		SR 51 SB: S of Cactus	7:00 A	Spd		45	43	42				
325	6:00 P	Vol	728			2,045	1,968	1,799		303	8:00 A	Vol		1,917	1,762	1,527				NA
SR 51 NB: N of Greenway	5:15 P	Spd				59	61	64		SR 51 SB: S of Bell	12:00 A	Spd		NA	NA	NA				
334	6:15 P	Vol	443			1,543	1,431	1,314		312	12:00 A	Vol		NA	NA	NA				NA
US 60 EB: E of Rural	4:45 P	Spd				34	46	58	58	US 60 WB: W of McClintock	7:00 A	Spd	50	26	31	22	24			
435	5:45 P	Vol	335			1,692	1,684	1,824	1,057	494	8:00 A	Vol	1,077	1,205	1,242	1,118	948			516
US 60 EB: E of Dobson	5:00 P	Spd		56	57	52	54	59	58	US 60 WB: W of Alma School	6:45 A	Spd	65	58	52	51	49	49		
444	6:00 P	Vol	761	1,554	1,644	1,468	1,654	1,843	967	485	7:45 A	Vol	988	1,676	1,497	1,744	768	769		179
US 60 EB: E of Mesa Dr	5:00 P	Spd		50	53	56	54	65	69	US 60 WB: W of Stapley	5:00 A	Spd	56	55	52	54	59	60		
453	6:00 P	Vol	476	1,689	1,533	1,379	1,430	1,579	963	476	6:00 A	Vol	1,063	1,401	1,253	1,215	1,091	871		298
US 60 EB: E of Gilbert	5:15 P	Spd			34	29	27	41	53	US 60 WB: W of Val Vista	6:00 A	Spd	56	53	53	49				
459	6:15 P	Vol	454		1,032	1,150	1,164	1,444	1,057	467	7:00 A	Vol	528	1,976	1,795	1,215				513

Table abbreviations: NB = northbound; EB = Eastbound; SB = southbound; WB = westbound; STN = station; ENT= entrance ramp; GP = general purpose (freeway mainlanes); HOV = high-occupancy vehicle; Spd = Speed; Vol = Volume; NA = No data available

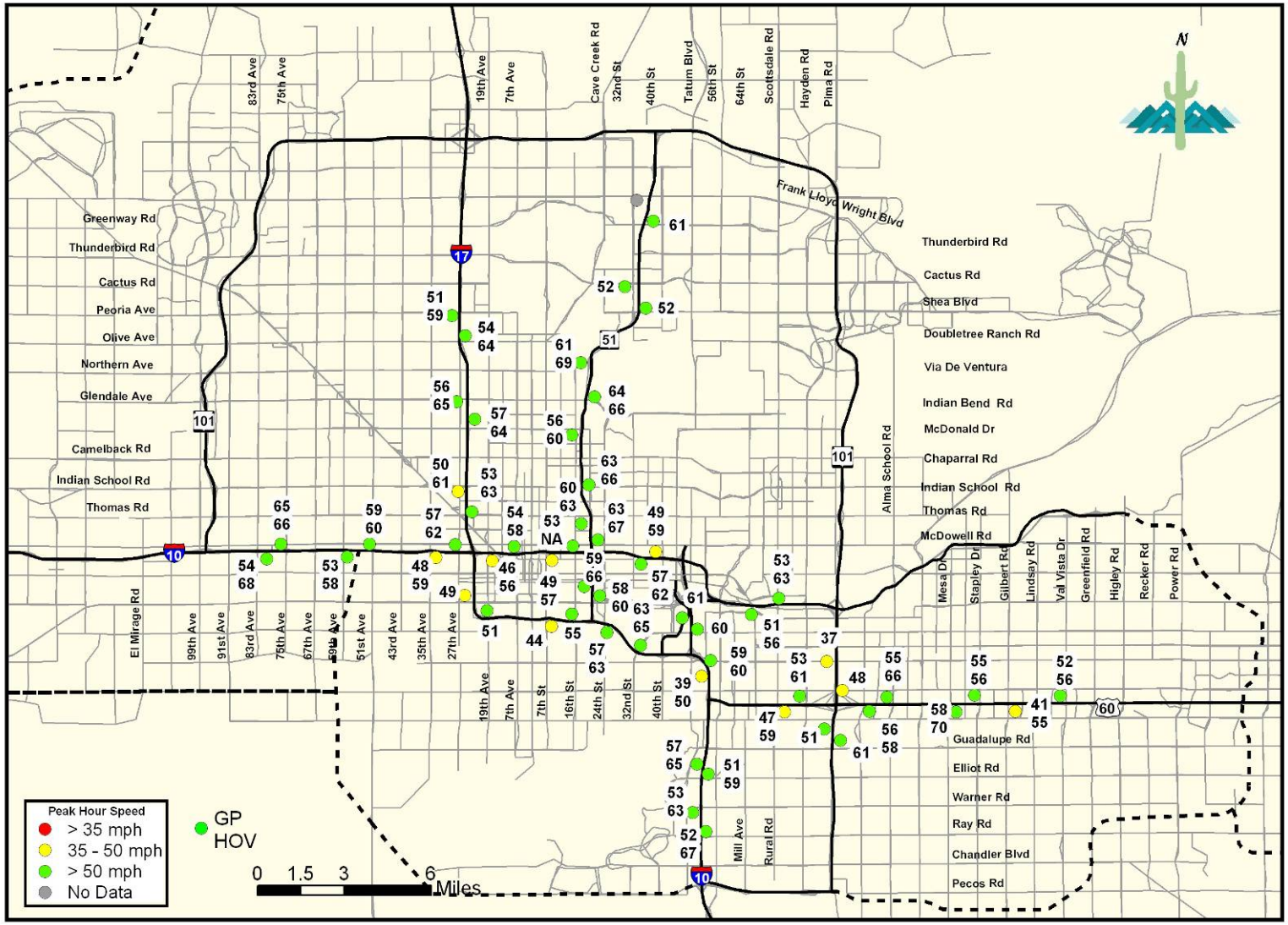

Figure 9. Average Weekday Peak Hour Speeds, 2004
(based on highest traffic volumes)

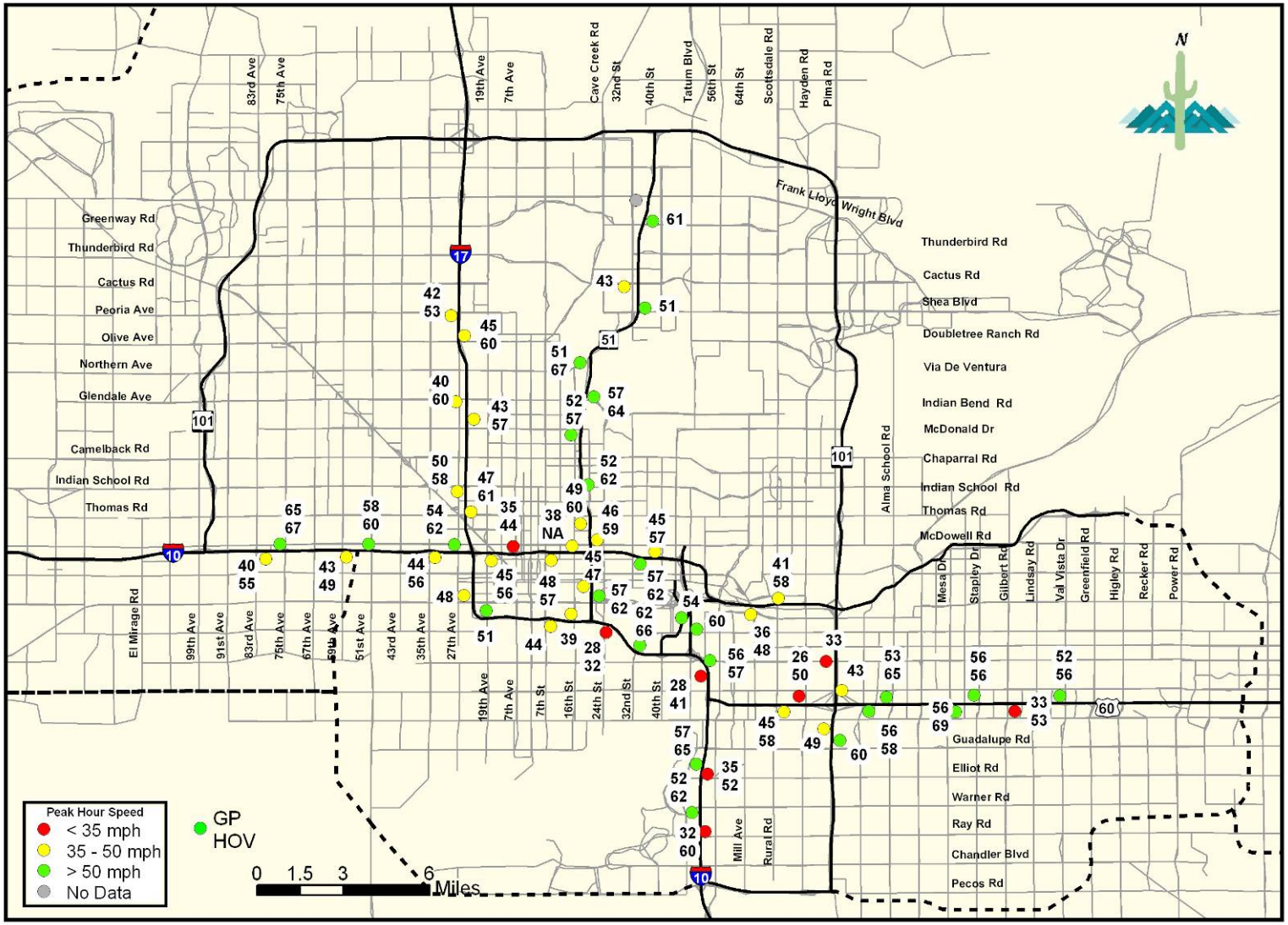

Figure 10. Average Weekday Peak Hour Speeds, 2004
(based on lowest travel speeds)

Table 3. Average Weekday Peak Hour Traffic Congestion Statistics, 2004 (peak hour based on highest traffic volumes)

			Freeway General Purpose Lanes					HOV Lane				
STN #	Location	Peak Hour	Volume (vphpl)	VMT (veh-mi)	Speed (mph)	Delay (veh-hr)	LOS	Volume (vphpl)	VMT (veh-mi)	Speed (mph)	Delay (veh-hr)	LOS
2	I-10 EB: E of 83rd Ave	5:45 A to 6:45 A	1,129	16,460	54	1,894	E	974	2,840	68	0	B
4	I-10 WB: W of 75th Ave	4:30 P to 5:30 P	1,100	13,491	65	0	B	1,144	3,505	66	4	B
20	I-10 EB: E of 59th Ave	5:45 A to 6:45 A	1,105	13,134	53	3,211	E	991	2,946	58	329	E
24	I-10 WB: W of 51st Ave	4:30 P to 5:30 P	1,580	19,107	59	162	E	1,207	3,650	60	12	C
68	I-10 EB: E of 35th Ave	5:45 A to 6:45 A	1,477	14,905	48	6,128	F	1,188	2,996	59	341	C
73	I-10 WB: W of 27th Ave	3:30 P to 4:30 P	1,516	19,396	57	0	E	1,783	4,562	62	0	C
75	I-10 EB: E of 19th Ave	7:00 A to 8:00 A	1,434	15,173	46	13,795	F	1,601	3,388	56	314	E
78	I-10 WB: W of 7th Ave	2:00 P to 3:00 P	1,825	15,756	54	398	E	1,152	2,486	58	68	E
85	I-10 EB: E of 7th St	6:45 A to 7:45 A	1,840	17,421	49	5,066	F	1,320	3,123	57	15	E
139	I-10 WB: W of 16th St	2:00 P to 3:00 P	1,692	21,603	53	4,335	E	NA	NA	NA	NA	NA
149	I-10 EB: S of Van Buren	5:00 A to 6:00 A	1,391	8,730	59	0	E	672	1,405	66	0	A
92	I-10 WB: N of Buckeye	7:15 A to 8:15 A	1,503	10,482	58	2,233	E	1,267	2,946	60	7	C
40	I-10 EB: E of 24th St	3:00 P to 4:00 P	1,634	20,269	57	3,503	E	946	2,347	63	146	C
47	I-10 WB: W of 32nd St	7:00 A to 8:00 A	1,633	21,886	63	57	C	1,154	3,093	65	14	C
64	I-10 EB: E of 48th St	3:00 P to 4:00 P	1,694	29,140	39	40,330	F	1,402	4,822	50	904	F
66	I-10 WB: N of Southern Ave	6:15 A to 7:15 A	2,146	32,819	59	155	E	1,426	4,360	60	171	E
401	I-10 EB: S of Guadalupe	4:45 P to 5:45 P	1,961	20,747	57	566	E	939	2,484	65	0	C
417	I-10 WB: N of Elliot	6:15 A to 7:15 A	1,873	15,007	51	4,418	F	958	2,559	59	98	E
406	I-10 EB: S of Warner	4:45 P to 5:45 P	1,983	10,173	53	259	E	736	1,258	63	0	C
411	I-10 WB: S of Elliot	6:00 A to 7:00 A	1,485	8,952	52	1,879	F	563	1,131	67	0	C
98	I-17 NB: 16th St	7:00 A to 8:00 A	1,618	15,471	55	2,171	E					
103	I-17 SB: E of 7th St	7:00 A to 8:00 A	1,448	14,248	44	17,929	F					
155	I-17 NB: N of Buckeye	3:30 P to 4:30 P	1,654	16,875	51	4,885	E					
118	I-17 SB: S of Van Buren	5:45 A to 6:45 A	1,599	16,257	49	4,827	F					
337	I-17 NB: N of Thomas	2:45 P to 3:45 P	1,511	15,031	53	1,700	E	740	2,236	63	0	B
376	I-17 SB: S of Indian School	6:30 A to 7:30 A	1,677	16,388	50	5,887	F	658	1,987	61	152	A
346	I-17 NB: S of Glendale	2:30 P to 3:30 P	1,585	14,720	57	931	E	1,075	3,327	64	33	C
367	I-17 SB: S of Glendale	3:30 P to 4:30 P	1,603	14,425	56	437	E	632	1,896	65	3	A
355	I-17 NB: N of Dunlap	3:15 P to 4:15 P	1,758	16,714	54	2,701	E	775	2,456	64	29	C
358	I-17 SB: S of Peoria	6:00 A to 7:00 A	1,533	13,704	51	2,961	F	805	2,400	59	19	D

Table abbreviations: NB = northbound; EB = Eastbound; SB = southbound; WB = westbound; STN = station; HOV = high-occupancy vehicle; VMT = vehicle-miles of travel; LOS = level of service; A = AM; P = PM; NA = No data available

Table 3 continued on next page

Table 3. Average Weekday Peak Hour Traffic Congestion Statistics, 2004 (Continued) (peak hour based on highest traffic volumes)

			Freeway General Purpose Lanes					HOV Lane				
STN #	Location	Peak Hour	Volume (vphpl)	VMT (veh-mi)	Speed (mph)	Delay (veh-hr)	LOS	Volume (vphpl)	VMT (veh-mi)	Speed (mph)	Delay (veh-hr)	LOS
264	Loop 101 NB: N of Southern	6:15 A to 7:15 A	1,532	16,317	48	9,830	F					
261	Loop 101 SB: S of Broadway	4:00 P to 5:00 P	1,881	16,346	37	20,871	F					
514	Loop 101 NB: N of Guadalupe	6:30 A to 7:30 A	1,622	13,822	61	79	E					
510	Loop 101 SB: S of Baseline	4:45 P to 5:45 P	1,722	14,966	51	5,401	F					
233	Loop 202 EB: E of 32nd St	4:30 P to 5:30 P	2,006	27,894	57	1,633	E	933	4,324	62	91	C
223	Loop 202 WB: W of 40th St	7:00 A to 8:00 A	1,557	30,473	49	18,307	F	740	3,621	59	54	E
246	Loop 202 EB: W of Priest	3:15 P to 4:15 P	1,772	32,854	51	14,871	F	921	4,270	56	391	E
278	Loop 202 WB: W of Scottsdale	6:15 A to 7:15 A	1,919	37,556	53	7,475	E	768	3,759	63	0	C
179	SR 143 NB: N of University	7:15 A to 8:15 A	1,748	10,489	60	0	C					
169	SR 143 SB: S of Washington	7:15 A to 8:15 A	1,243	11,186	61	16	C					
203	SR 51 NB: N of McDowell	3:15 P to 4:15 P	1,357	11,961	63	50	C	431	857	67	0	A
190	SR 51 SB: S of Thomas	6:30 A to 7:30 A	1,672	17,343	60	394	C	461	1,439	63	0	C
209	SR 51 NB: N of Indian School	3:30 P to 4:30 P	1,709	12,954	63	25	C	694	1,763	66	9	A
198	SR 51 SB: S of Bethany	6:30 A to 7:30 A	1,849	15,447	56	272	E	703	1,973	60	4	C
313	SR 51 NB: N of Glendale	3:45 P to 4:45 P	1,729	17,575	64	898	C	698	2,158	66	0	C
294	SR 51 SB: S of Northern	6:30 A to 7:30 A	1,096	12,082	61	567	C	628	1,564	69	0	A
325	SR 51 NB: N of Shea	4:45 P to 5:45 P	1,966	20,704	52	2,642	F					
303	SR 51 SB: S of Cactus	6:30 A to 7:30 A	1,869	18,086	52	5,474	F					
334	SR 51 NB: N of Greenway	5:00 P to 6:00 P	1,459	13,528	61	0	C					
312	SR 51 SB: S of Bell	NA	NA	NA	NA	NA	NA					
435	US 60 EB: E of Rural	4:00 P to 5:00 P	1,752	15,399	47	7,244	F	1,064	3,116	59	0	D
494	US 60 WB: W of McClintock	5:45 A to 6:45 A	1,444	18,023	53	3,622	E	1,009	3,148	61	168	B
444	US 60 EB: E of Dobson	4:15 P to 5:15 P	1,670	24,927	56	447	E	977	2,915	58	1	D
485	US 60 WB: W of Alma School	6:15 A to 7:15 A	1,511	22,960	55	5,264	E	872	2,651	66	17	B
453	US 60 EB: E of Mesa Dr	4:15 P to 5:15 P	1,565	19,518	58	3,457	E	926	2,311	70	0	B
476	US 60 WB: W of Stapley	6:15 A to 7:15 A	1,535	22,828	55	1,111	C	714	2,124	56	24	B
459	US 60 EB: E of Gilbert	4:15 P to 5:15 P	1,298	10,127	41	21,565	F	1,009	1,968	55	54	C
467	US 60 WB: W of Val Vista	6:00 A to 7:00 A	1,657	14,860	52	496	E	528	1,579	56	7	A

Table abbreviations: NB = northbound; EB = Eastbound; SB = southbound; WB = westbound; STN = station; HOV = high-occupancy vehicle; VMT = vehicle-miles of travel; LOS = level of service; A = AM; P = PM; NA = No data available

Table 4. Average Weekday Peak Hour Traffic Congestion Statistics, 2004 (peak hour based on lowest travel speeds)

			Freeway General Purpose Lanes					HOV Lane				
STN #	Location	Peak Hour	Volume (vphpl)	VMT (veh-mi)	Speed (mph)	Delay (veh-hr)	LOS	Volume (vphpl)	VMT (veh-mi)	Speed (mph)	Delay (veh-hr)	LOS
2	I-10 EB: E of 83rd Ave	7:00 A to 8:00 A	973	14,188	40	38,826	F	973	2,835	55	1,777	E
4	I-10 WB: W of 75th Ave	5:00 A to 6:00 A	598	7,337	65	0	A	561	1,718	67	4	A
20	I-10 EB: E of 59th Ave	7:00 A to 8:00 A	935	11,112	43	15,683	F	944	2,807	49	2,358	F
24	I-10 WB: W of 51st Ave	5:00 P to 6:00 P	1,561	18,872	58	205	E	1,222	3,694	60	20	C
68	I-10 EB: E of 35th Ave	7:15 A to 8:15 A	1,432	14,451	44	14,409	F	1,200	3,028	56	333	C
73	I-10 WB: W of 27th Ave	5:15 A to 6:15 A	607	7,760	54	0	E	517	1,323	62	0	A
75	I-10 EB: E of 19th Ave	7:15 A to 8:15 A	1,434	15,170	45	15,436	F	1,588	3,360	56	286	E
78	I-10 WB: W of 7th Ave	4:45 P to 5:45 P	1,683	14,527	35	12,742	F	1,049	2,264	44	1,713	F
85	I-10 EB: E of 7th St	7:15 A to 8:15 A	1,813	17,161	48	6,204	F	1,253	2,964	57	28	E
139	I-10 WB: W of 16th St	4:45 P to 5:45 P	1,279	16,333	38	44,044	F	NA	NA	NA	NA	NA
149	I-10 EB: S of Van Buren	4:45 P to 5:45 P	1,368	8,586	45	10,266	F	728	1,522	47	3,067	F
92	I-10 WB: N of Buckeye	3:45 P to 4:45 P	1,346	9,390	57	2,471	E	1,129	2,625	62	7	C
40	I-10 EB: E of 24th St	4:45 P to 5:45 P	1,177	14,602	28	80,312	F	1,188	2,947	32	12,596	F
47	I-10 WB: W of 32nd St	3:45 P to 4:45 P	1,450	19,431	62	717	C	837	2,243	66	23	C
64	I-10 EB: E of 48th St	5:00 P to 6:00 P	1,571	27,009	28	101,521	F	1,722	5,924	41	5,969	F
66	I-10 WB: N of Southern Ave	7:00 A to 8:00 A	2,106	32,213	56	922	E	1,804	5,518	57	213	E
401	I-10 EB: S of Guadalupe	5:15 P to 6:15 P	1,921	20,325	57	690	E	962	2,545	65	0	C
417	I-10 WB: N of Elliot	7:15 A to 8:15 A	1,450	11,614	35	28,056	F	1,214	3,241	52	938	F
406	I-10 EB: S of Warner	5:15 P to 6:15 P	1,940	9,951	52	431	F	753	1,288	62	0	C
411	I-10 WB: S of Elliot	7:00 A to 8:00 A	1,067	6,431	32	32,116	F	965	1,940	60	7	E
98	I-17 NB: 16th St	3:30 P to 4:30 P	1,587	15,180	39	26,580	F					
103	I-17 SB: E of 7th St	7:00 A to 8:00 A	1,448	14,248	44	17,929	F					
155	I-17 NB: N of Buckeye	4:00 P to 5:00 P	1,651	16,842	51	5,887	F					
118	I-17 SB: S of Van Buren	6:30 A to 7:30 A	1,503	15,279	48	10,100	F					
337	I-17 NB: N of Thomas	4:45 P to 5:45 P	1,427	14,202	47	10,979	F	724	2,186	61	19	B
376	I-17 SB: S of Indian School	5:45 A to 6:45 A	1,613	15,765	50	6,156	F	726	2,193	58	217	D
346	I-17 NB: S of Glendale	5:00 P to 6:00 P	1,469	13,638	43	13,738	F	835	2,585	57	65	E
367	I-17 SB: S of Glendale	7:15 A to 8:15 A	1,422	12,795	40	21,270	F	523	1,569	60	15	D
355	I-17 NB: N of Dunlap	5:00 P to 6:00 P	1,686	16,034	45	13,048	F	773	2,450	60	0	C
358	I-17 SB: S of Peoria	7:00 A to 8:00 A	1,393	12,452	42	18,153	F	1,014	3,021	53	682	E

Table abbreviations: NB = northbound; EB = Eastbound; SB = southbound; WB = westbound; STN = station; HOV = high-occupancy vehicle; VMT = vehicle-miles of travel; LOS = level of service; A = AM; P = PM; NA = No data available

Table 4 continued on next page

Table 4. Average Weekday Peak Hour Traffic Congestion Statistics, 2004 (peak hour based on lowest travel speeds)

			Freeway General Purpose Lanes					HOV Lane				
STN #	Location	Peak Hour	Volume (vphpl)	VMT (veh-mi)	Speed (mph)	Delay (veh-hr)	LOS	Volume (vphpl)	VMT (veh-mi)	Speed (mph)	Delay (veh-hr)	LOS
264	Loop 101 NB: N of Southern	6:45 A to 7:45 A	1,473	15,682	43	16,664	F					
261	Loop 101 SB: S of Broadway	5:00 P to 6:00 P	1,814	15,769	33	31,177	F					
514	Loop 101 NB: N of Guadalupe	7:00 A to 8:00 A	1,596	13,594	60	462	E					
510	Loop 101 SB: S of Baseline	5:00 P to 6:00 P	1,710	14,860	49	7,231	F					
233	Loop 202 EB: E of 32nd St	4:45 P to 5:45 P	1,995	27,731	57	1,794	E	936	4,335	62	71	C
223	Loop 202 WB: W of 40th St	7:30 A to 8:30 A	1,524	29,827	45	33,862	F	700	3,425	57	104	E
246	Loop 202 EB: W of Priest	4:45 P to 5:45 P	1,674	31,023	36	67,798	F	1,250	5,794	48	2,009	F
278	Loop 202 WB: W of Scottsdale	7:15 A to 8:15 A	1,804	35,305	41	52,369	F	844	4,128	58	16	E
179	SR 143 NB: N of University	7:15 A to 8:15 A	1,748	10,489	60	0	C					
169	SR 143 SB: S of Washington	5:00 P to 6:00 P	1,084	9,757	54	5,448	E					
203	SR 51 NB: N of McDowell	4:45 P to 5:45 P	1,072	9,453	46	5,626	F	631	1,255	59	20	E
190	SR 51 SB: S of Thomas	4:45 P to 5:45 P	1,228	12,732	49	3,800	F	476	1,486	60	66	C
209	SR 51 NB: N of Indian School	5:00 P to 6:00 P	1,412	10,701	52	1,086	F	794	2,016	62	35	C
198	SR 51 SB: S of Bethany	7:15 A to 8:15 A	1,662	13,889	52	1,284	F	799	2,240	57	68	E
313	SR 51 NB: N of Glendale	5:00 P to 6:00 P	1,560	15,861	57	6,259	E	813	2,511	64	0	C
294	SR 51 SB: S of Northern	7:15 A to 8:15 A	910	10,031	51	5,455	F	726	1,808	67	0	B
325	SR 51 NB: N of Shea	5:00 P to 6:00 P	1,938	20,404	51	3,329	F					
303	SR 51 SB: S of Cactus	7:00 A to 8:00 A	1,735	16,790	43	17,761	F					
334	SR 51 NB: N of Greenway	5:15 P to 6:15 P	1,429	13,250	61	0	C					
312	SR 51 SB: S of Bell	NA	NA	NA	NA	NA	NA					
435	US 60 EB: E of Rural	4:45 P to 5:45 P	1,726	15,167	45	9,166	F	1,057	3,096	58	0	D
494	US 60 WB: W of McClintock	7:00 A to 8:00 A	1,123	14,019	26	96,248	F	1,077	3,361	50	966	F
444	US 60 EB: E of Dobson	5:00 P to 6:00 P	1,633	24,373	56	612	E	967	2,885	58	2	D
485	US 60 WB: W of Alma School	6:45 A to 7:45 A	1,447	22,000	53	10,046	E	984	2,992	65	8	C
453	US 60 EB: E of Mesa Dr	5:00 P to 6:00 P	1,524	19,017	56	5,164	E	965	2,407	69	0	B
476	US 60 WB: W of Stapley	5:00 A to 6:00 A	1,162	17,279	56	14	C	1,063	3,162	56	10	C
459	US 60 EB: E of Gilbert	5:15 P to 6:15 P	1,198	9,341	33	31,014	F	1,057	2,061	53	65	E
467	US 60 WB: W of Val Vista	6:00 A to 7:00 A	1,657	14,860	52	496	E	528	1,579	56	7	A

Table abbreviations: NB = northbound; EB = Eastbound; SB = southbound; WB = westbound; STN = station; HOV = high-occupancy vehicle; VMT = vehicle-miles of travel; LOS = level of service; A = AM; P = PM; NA = No data available

Peak Period Statistics

At many locations in Phoenix, congestion occurs outside of a single peak hour. To reflect the congestion outside of the peak hour, the following hours are defined for peak periods:

- Morning peak period: 6 to 9 am
- Evening peak period: 3 to 7 pm

These peak periods are fixed and identical for all 58 TMS sites.

Figure 11 shows a map of average morning peak period speeds for the general purpose and HOV lanes. Figure 12 shows a map of average evening peak period speeds for the general purpose and HOV lanes.

The average morning and evening peak period speeds were also calculated for the years 2000 through 2003. Because numerous data collection sites did not produce data prior to 2003, this year is used for trend comparisons. Figure 13 shows the percent change in morning peak period speeds from 2003 to 2004. Figure 14 shows the percent change in evening peak period speeds from 2003 to 2004.

The morning and evening peak periods do capture most of the congestion that occurs; however, as congestion grows and peak traffic spreads throughout the day, it is desirable to define an extended AM period as 5 to 10 am and an extended PM period as 2 to 7 pm. These extended periods were also used in the calculation of congestion duration.

Figure 15 shows a map of average extended AM period speeds and Figure 16 shows a map of average extended PM period speeds.

Freeway Performance by Time of Day

The traffic information and statistics presented earlier in this chapter have been averages or subtotals for a longer time period, such as an hour or several hours. It is useful to examine the traffic patterns throughout the entire day. In this way, one can determine the exact time(s) when traffic flows reach capacity and travel becomes congested. Or if the traffic is not congested, one can see the typical traffic peaking characteristics throughout the day.

Figure 17 shows an example chart that illustrates traffic flow rates and speeds for an average weekday for all lanes at a specific TMS site. Charts like this for all 58 TMS sites are shown in the Appendix.

Figure 18 shows an example chart that illustrates traffic flow rates and speeds for an average weekday for all general purpose lanes combined and the HOV lane at a specific TMS site. Charts like this for all 58 TMS sites are shown in the Appendix.

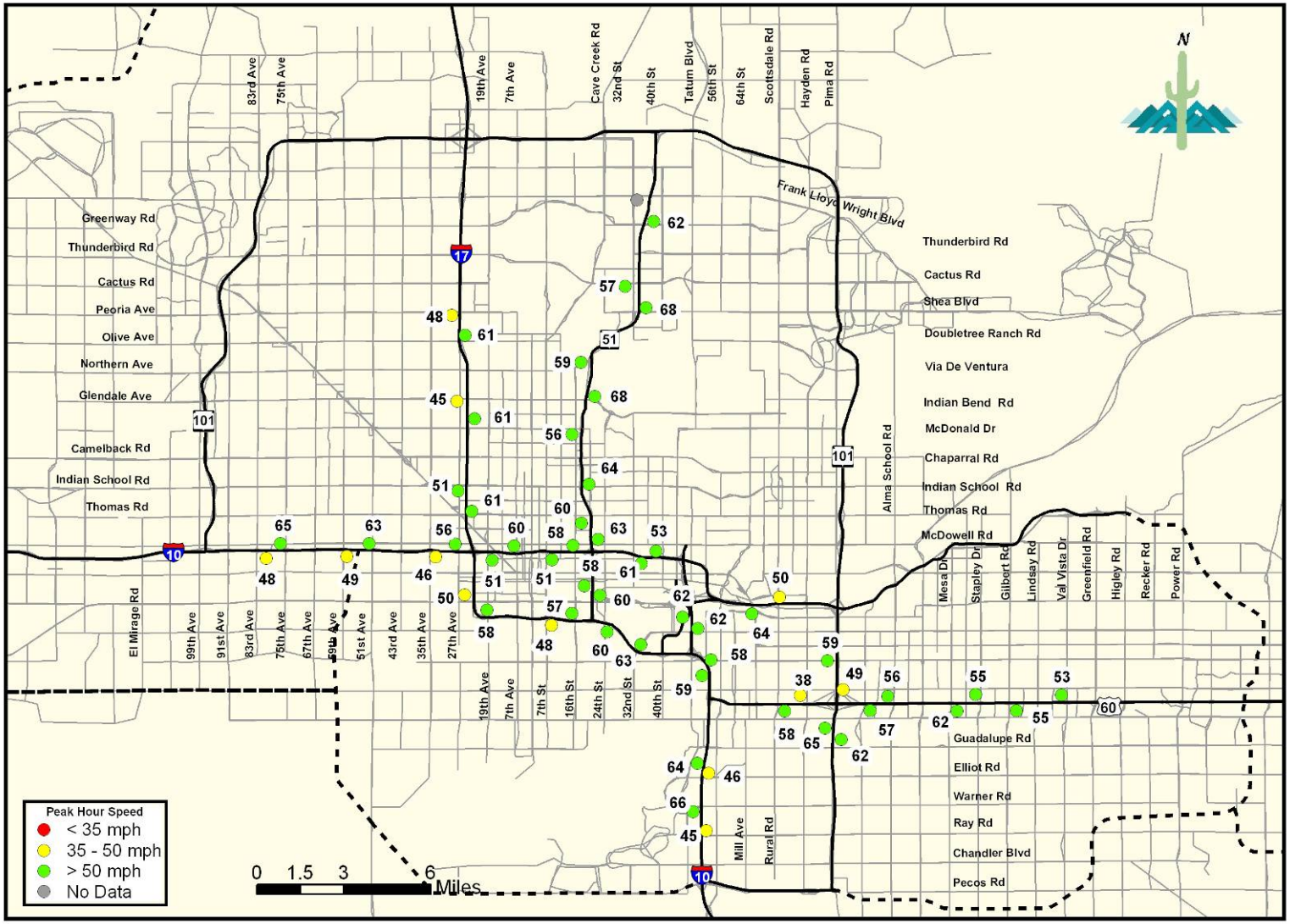

Figure 11. Average Speeds for Weekday Morning Peak Period (6 to 9 am), 2004

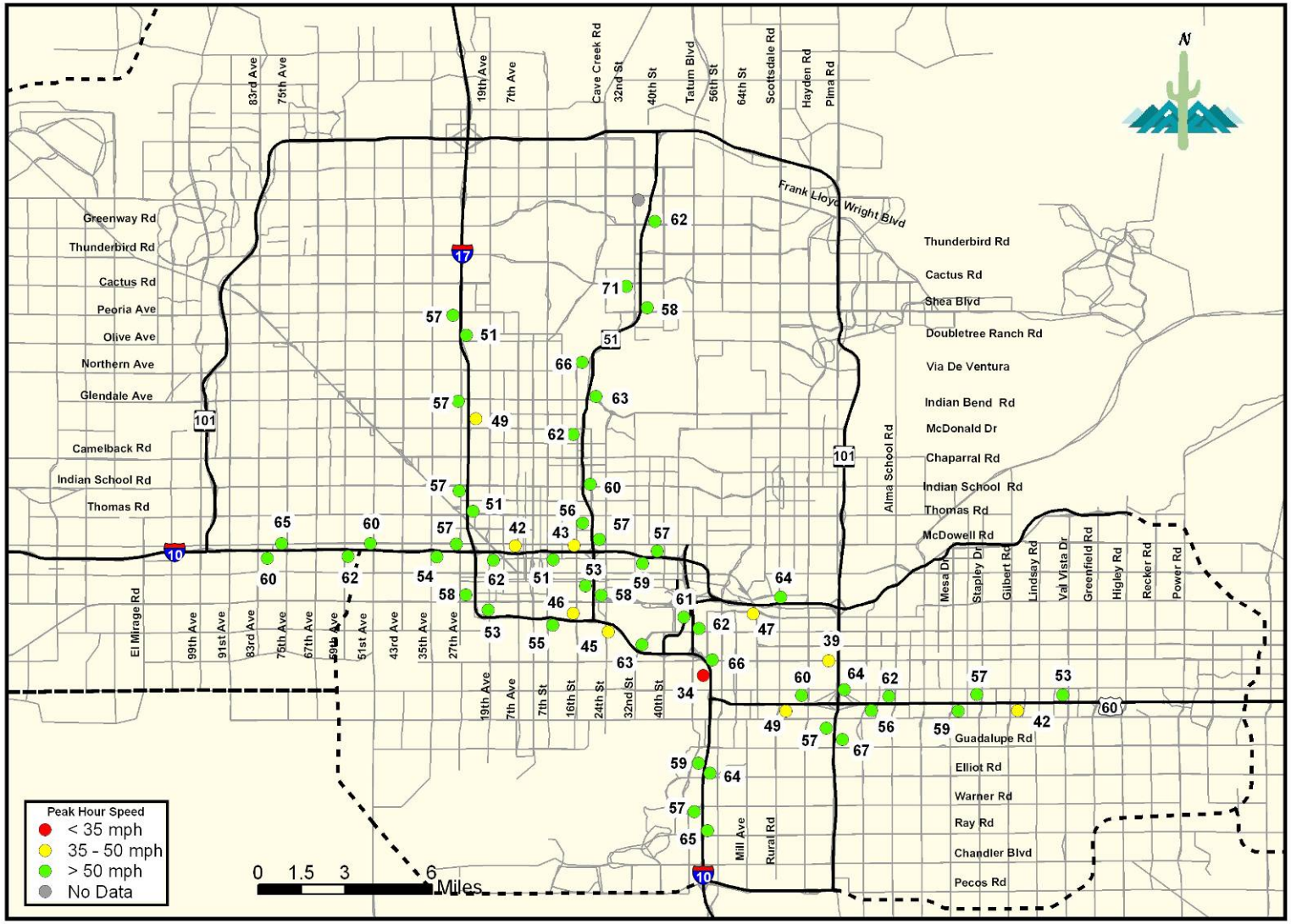

Figure 12. Average Speeds for Weekday Evening Peak Period (3 to 7 pm), 2004

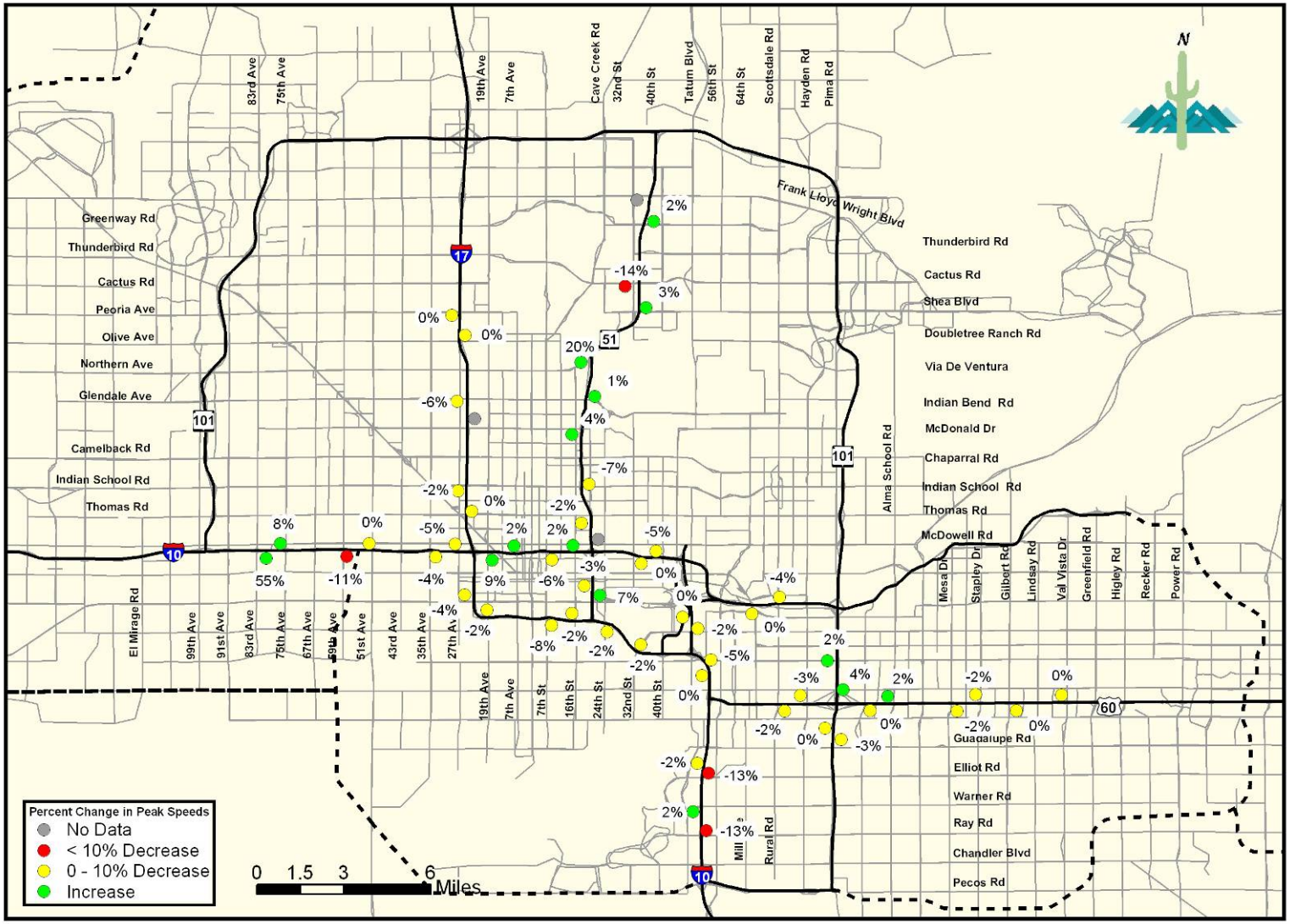

Figure 13. Percent Change in Average Weekday Morning Peak Period (6 to 9 am) Speeds, 2003 to 2004

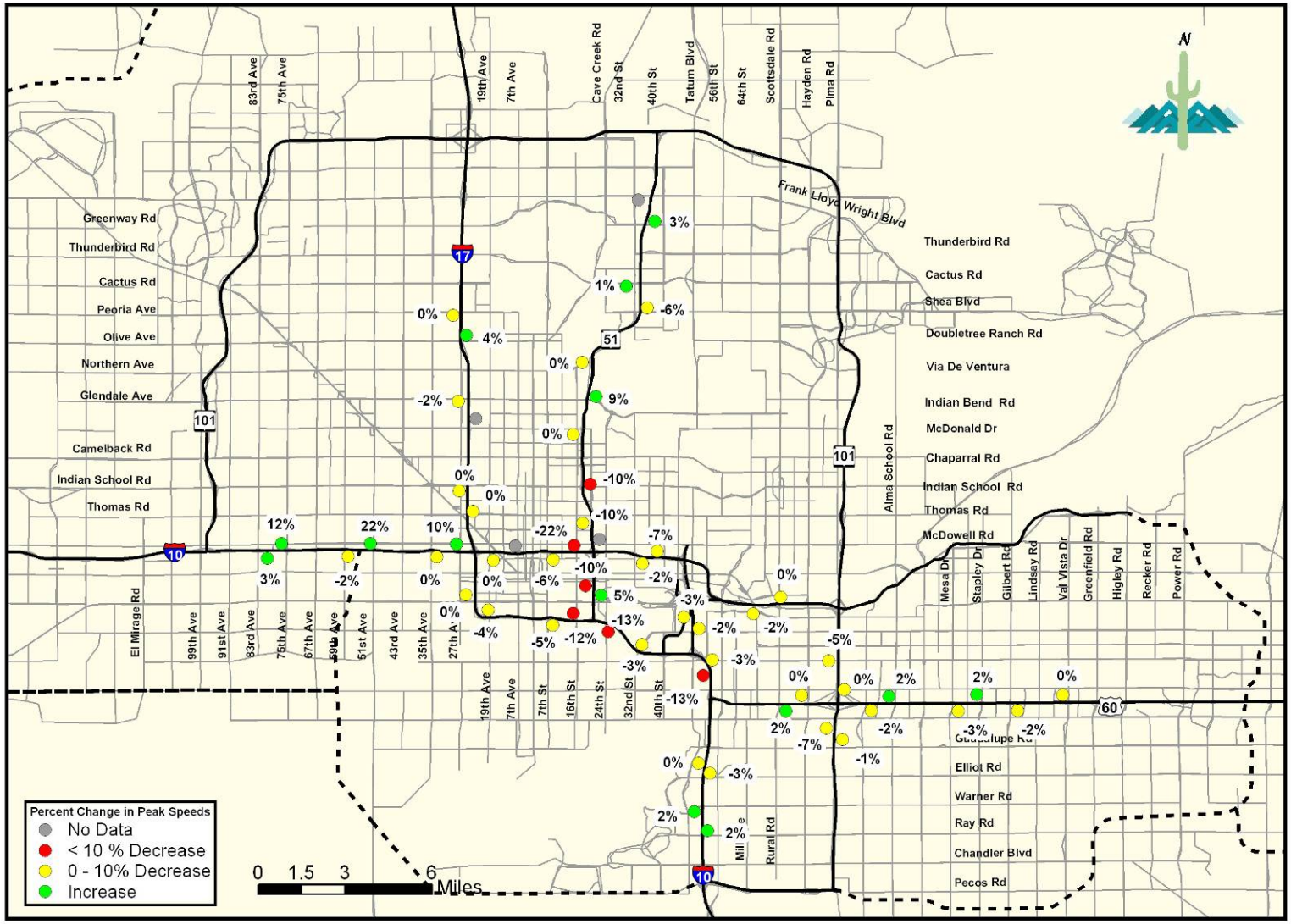

Figure 14. Percent Change in Average Weekday Evening Peak Period (3 to 7 pm) Speeds, 2003 to 2004

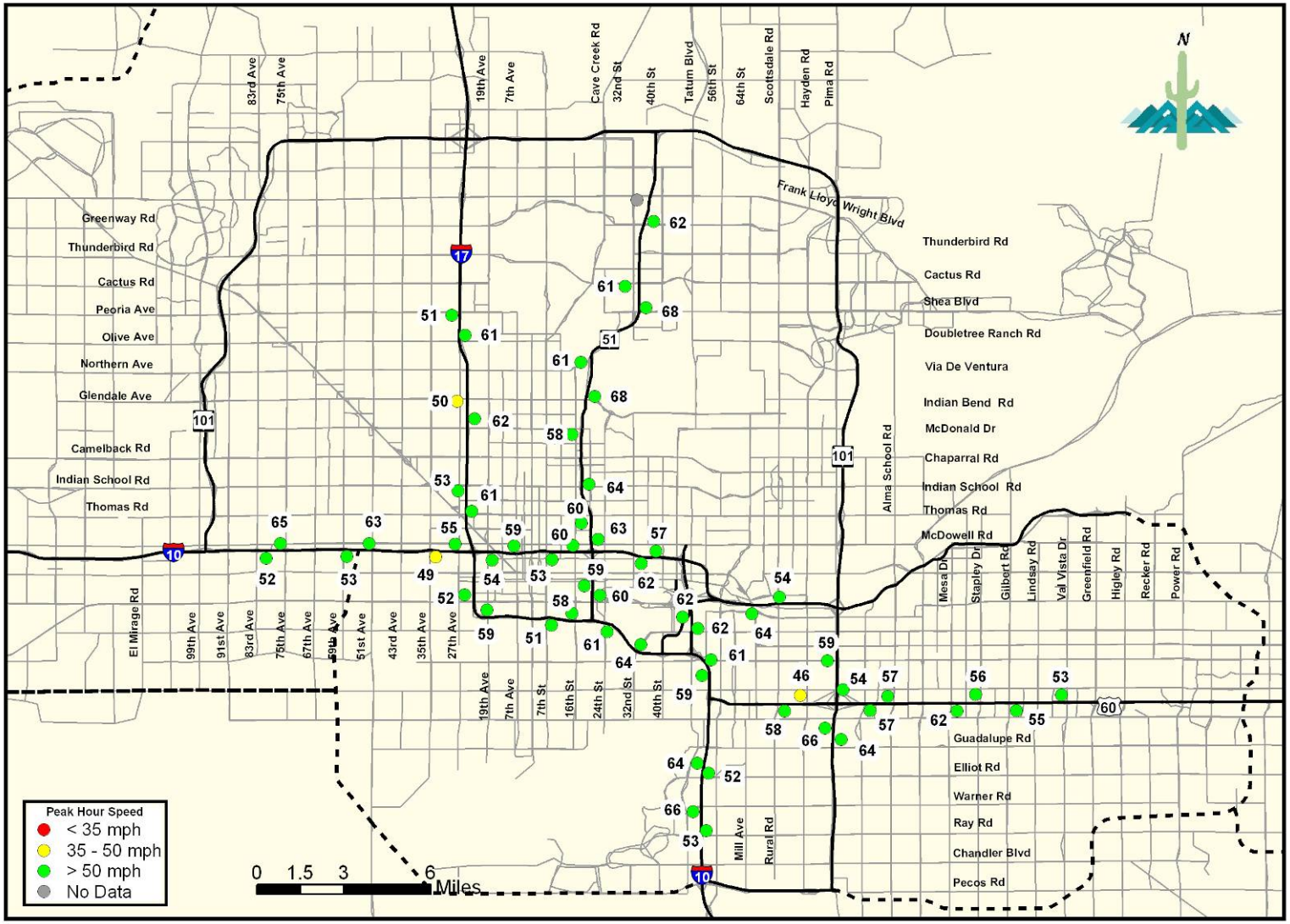

Figure 15. Average Speeds for Weekday Morning Extended Peak Period (5 to 10 am), 2004

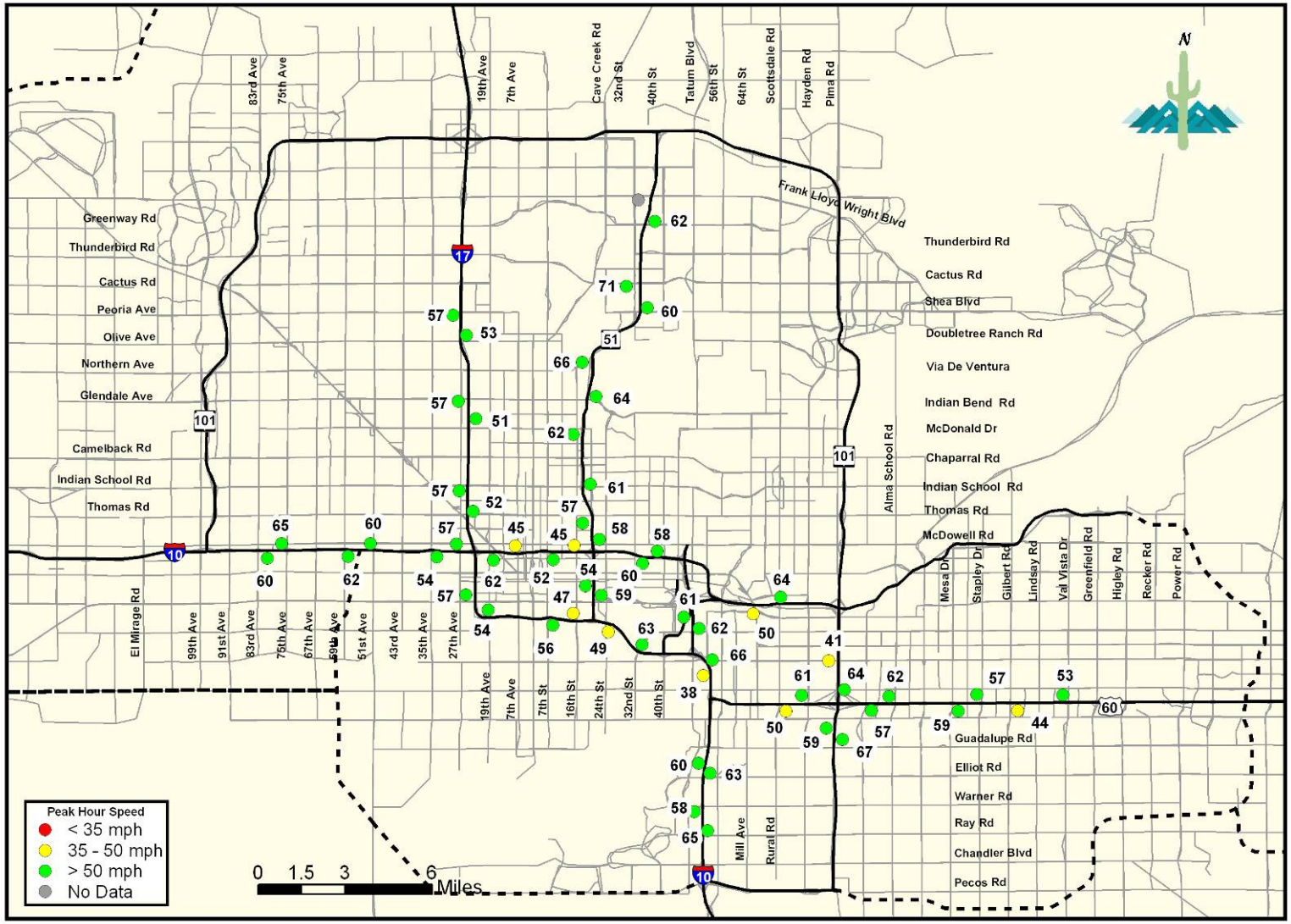

Figure 16. Average Speeds for Weekday Evening Extended Peak Period (2 to 7 pm), 2004

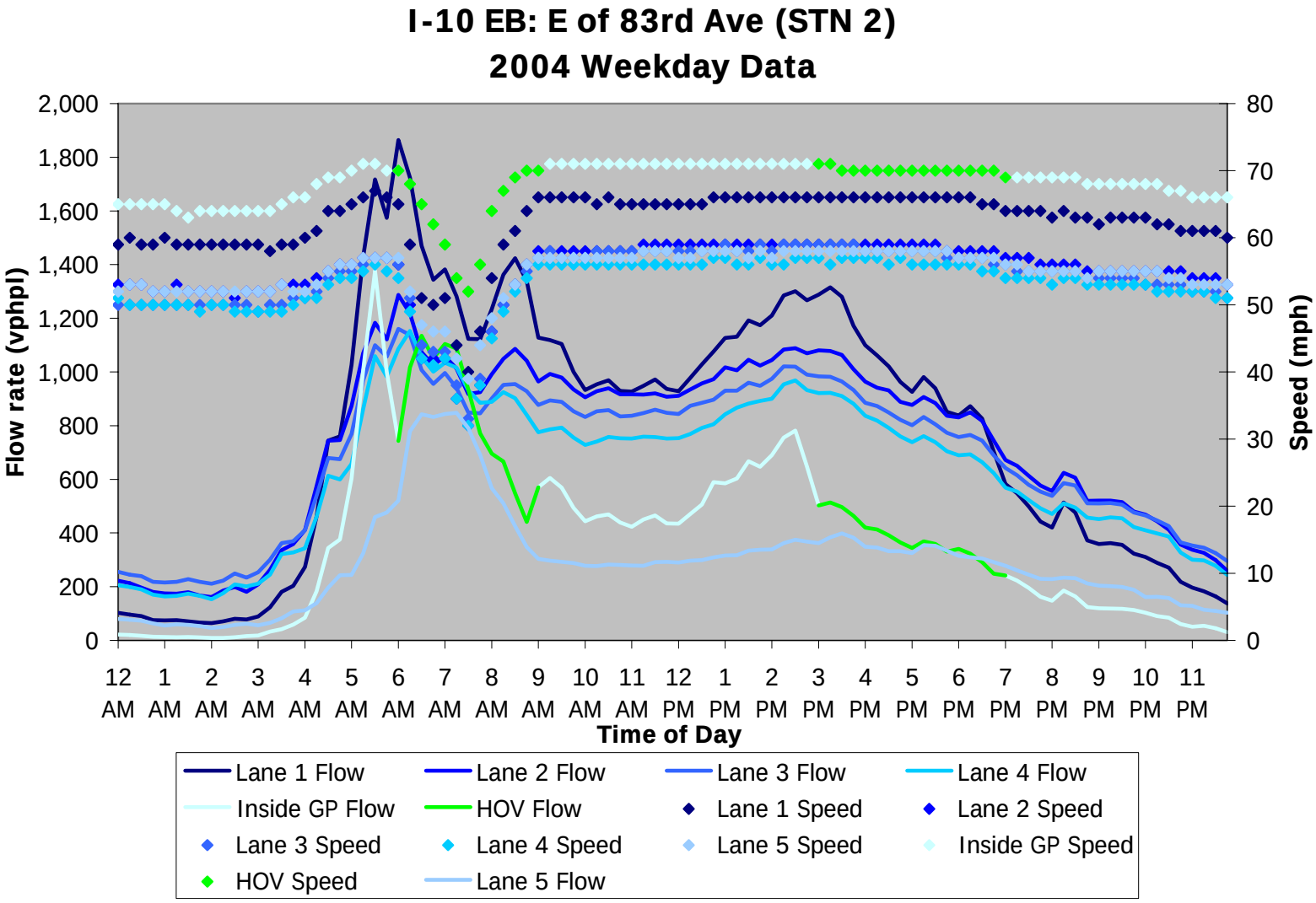

Figure 17. Example of Lane-by-Lane Speed and Flow Charts, 2004

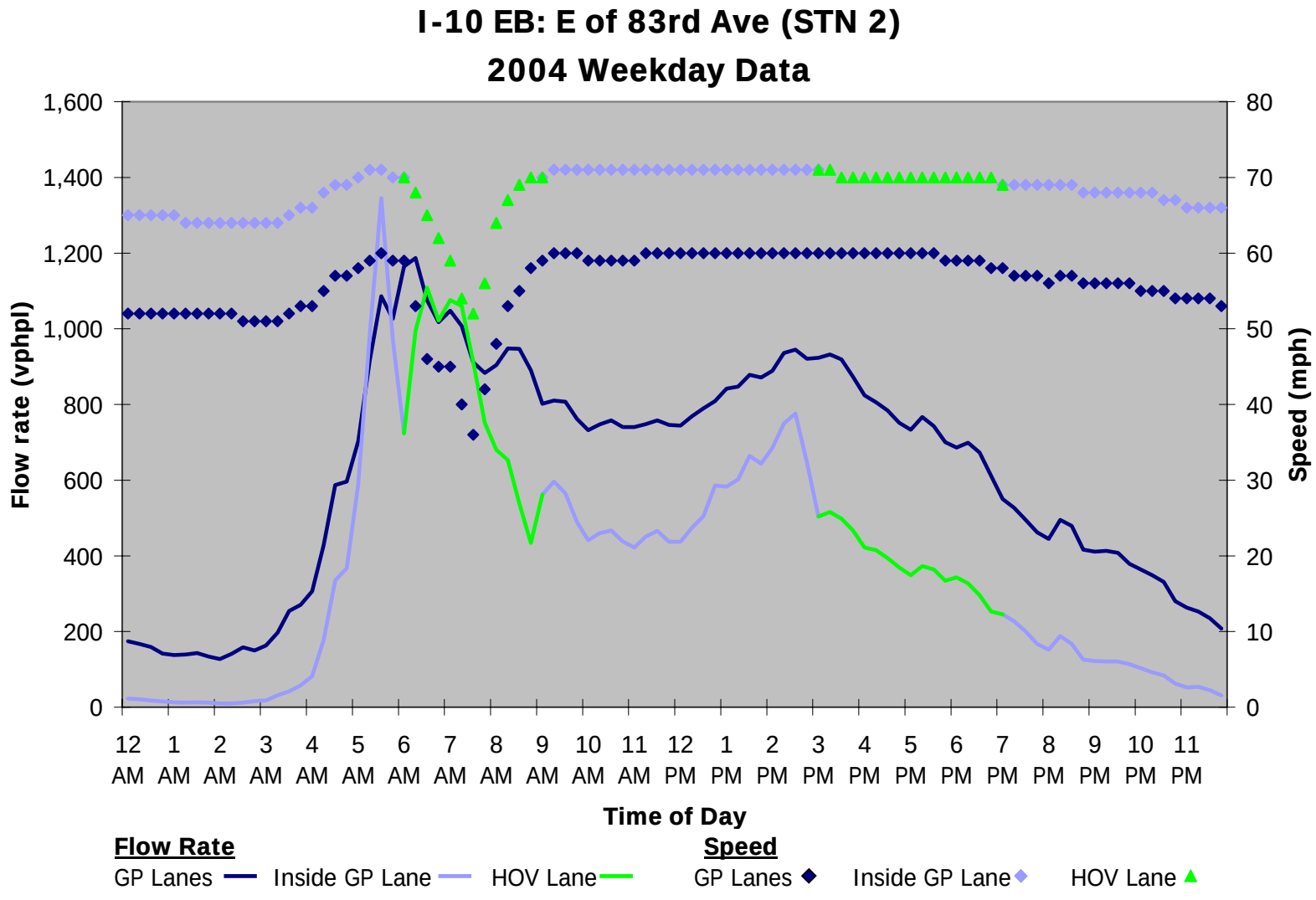

Figure 18. Example of Combined Lanes Speed and Flow Charts, 2004

Calculations of "Lost Capacity"

It has been well documented in the Highway Capacity Manual (HCM) that vehicle throughput is lower when traffic flow is unstable or congested. In the HCM, default capacity values for basic freeway segments range from 2,250 to 2,400 passenger cars per hour per lane (pcphpl). However, these capacity values are only attainable for a short period of time as traffic flows are building. Once capacity has been reached, traffic flow becomes unstable and congested. In unstable traffic flow, peak flow rates vary considerably, but are in the range of 1,000 to 1,500 pcphpl. This trend of lower traffic flow rates can be seen in Figures 17 and 18.

Thus, when traffic flow is congested, the freeway segment is not operating at peak efficiency (i.e., capacity). For example, a congested 4-lane freeway may only be carrying the equivalent 3 full lanes of traffic at capacity. It is useful to quantify this inefficiency associated with congested traffic. In other studies, this concept has been called "lost capacity" because the fixed capacity of the freeway is not being used efficiently because of congested traffic flow.

Figure 19 provides an illustration of lost capacity using data from 2 consecutive days at a single location. The figure shows that on November 12, the freeway became congested in the afternoon and the traffic flows and speeds dropped. The speeds returned to free-flow several hours later. On November 13, the traffic flows were consistently high but traffic never became congested and speeds never slowed. It would be a tremendous benefit to be able to manage freeway traffic such that most days were like November 13 (traffic at or near capacity but speeds not dropping) than November 12.

The 2004 data at the 58 TMS sites were analyzed to determine how much capacity was "lost" during the peak hours shown in Table 1. The procedures for calculating lost capacity are similar to those illustrated in Figure 19:

1. Identify and segregate the locations and days where traffic flow was congested;
2. Compare these congested days to the peak efficiency available on the freeway (according to the HCM);
3. Calculate the difference between the actual vehicle throughput with congestion and the peak vehicle throughput at capacity; and
4. Sum the lost capacity values over all congested days.

The results of this analysis are summarized below in Table 5 (and shown in Figure 20). The results show that over 10% of the freeway capacity (28 of 258 total physical lanes) is "lost" due to inefficient, congested traffic flows. These concepts will be explored in greater detail in future analyses and reports.

Table 5. Top Ten Locations for "Lost Capacity"

Location	Peak Hour Efficiency	Physical Lanes	Lanes "Lost"
I-10 EB: E of 24th St	63%	5	1.8
I-10 EB: E of 59th Ave	59%	4	1.7
US 60 WB: W of McClintock	62%	4	1.5
I-10 WB: W of 16th St	75%	6	1.5
I-10 EB: E of 83rd Ave	71%	5	1.5
SR 51 SB: S of Northern	68%	4	1.3
US 60 EB: E of Gilbert	68%	4	1.3
I-10 WB: S of Elliot	67%	3	1.0
I-10 EB: E of 48th St	82%	5	0.9
I-10 EB: E of 35th Ave	78%	4	0.9
All 58 Locations	**91%**	**258**	**28**

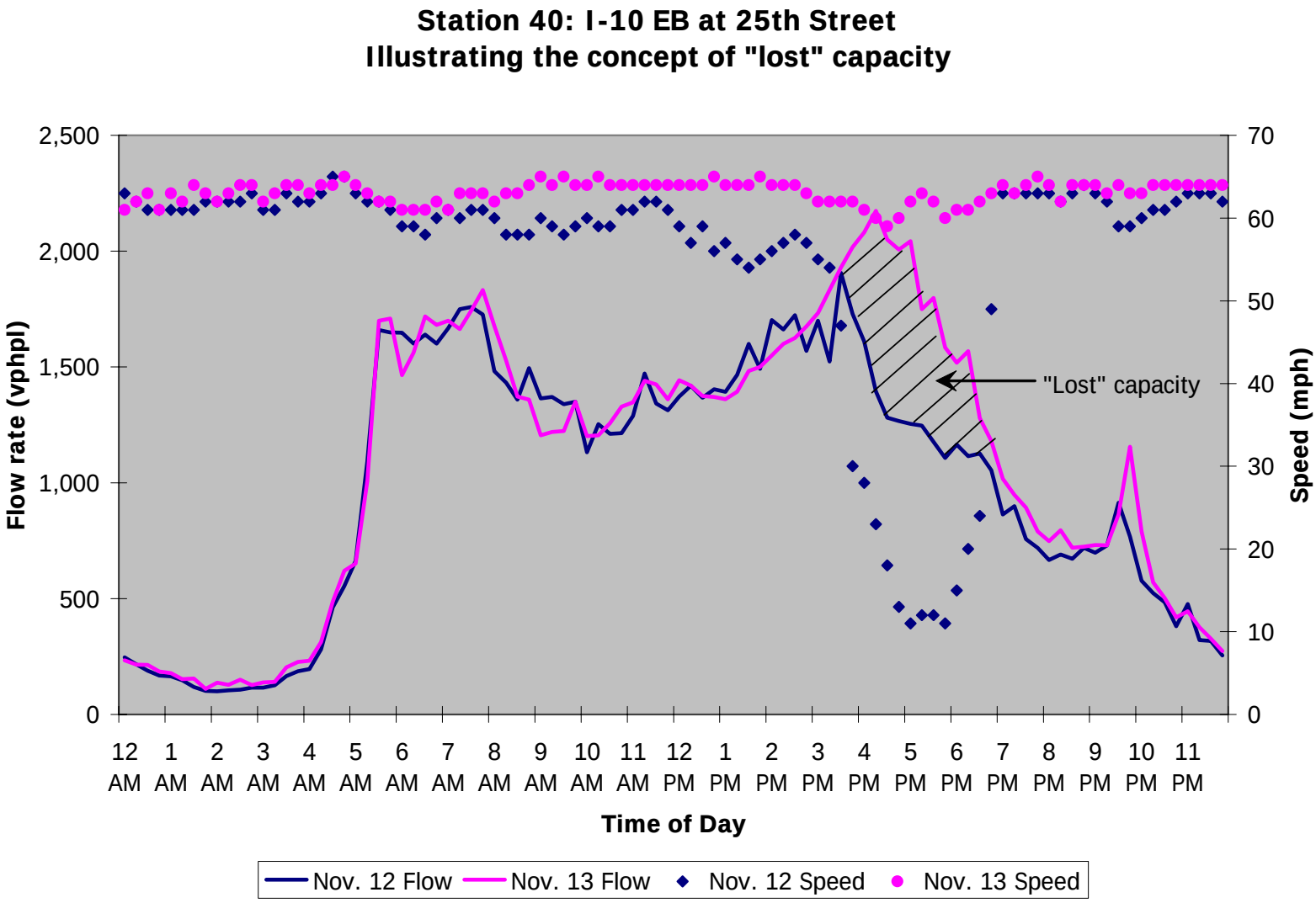

Figure 19. Illustration of "Lost Capacity"

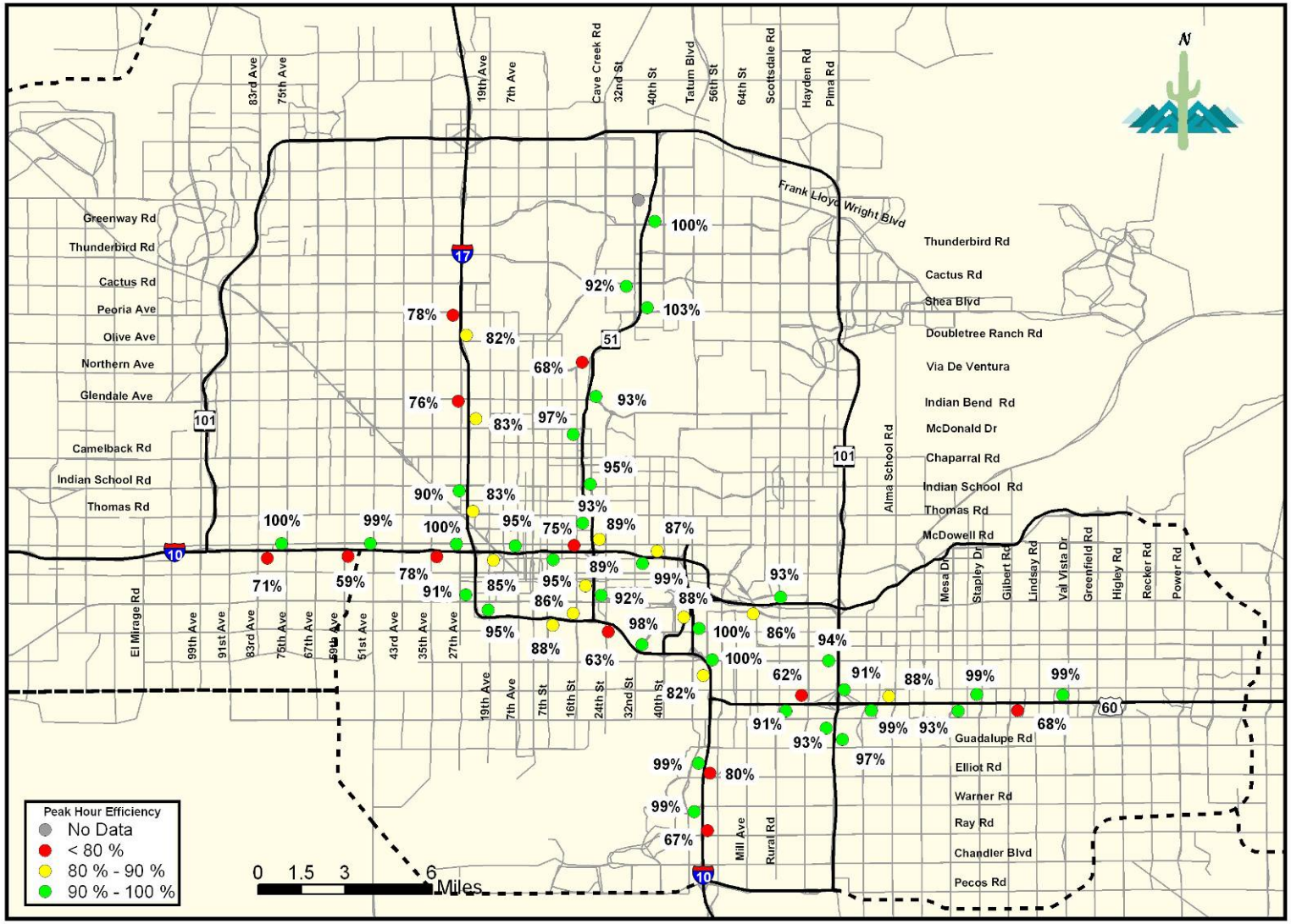

Figure 20. Peak Hour Efficiency Values Based on "Lost Capacity" Concepts

The lost capacity procedures were used to calculate peak hour efficiency values for the years 2000 through 2003. Because numerous data collection sites did not produce data prior to 2003, this year is used for trend comparisons. Figure 21 shows the change in peak hour efficiency values from 2003 to 2004.

Frequency of Congestion

The frequency of congestion is related to travel reliability, which is important for commuters, shippers, and other travelers that need to be at certain destination at a certain time. In this report, congestion frequency is measured as the percent of weekdays when peak period speeds were congested (below 50 mph). If the congestion frequency is high, then it is very likely that traffic will be congested at that location. Conversely, if the congestion frequency is low, then it is not very likely that traffic will be congested at that location.

Figure 22 shows the congestion frequency for the morning peak period (6 am to 9 am) for 2004, and Figure 23 shows the congestion frequency for the evening peak period (3 pm to 7 pm) for 2004.

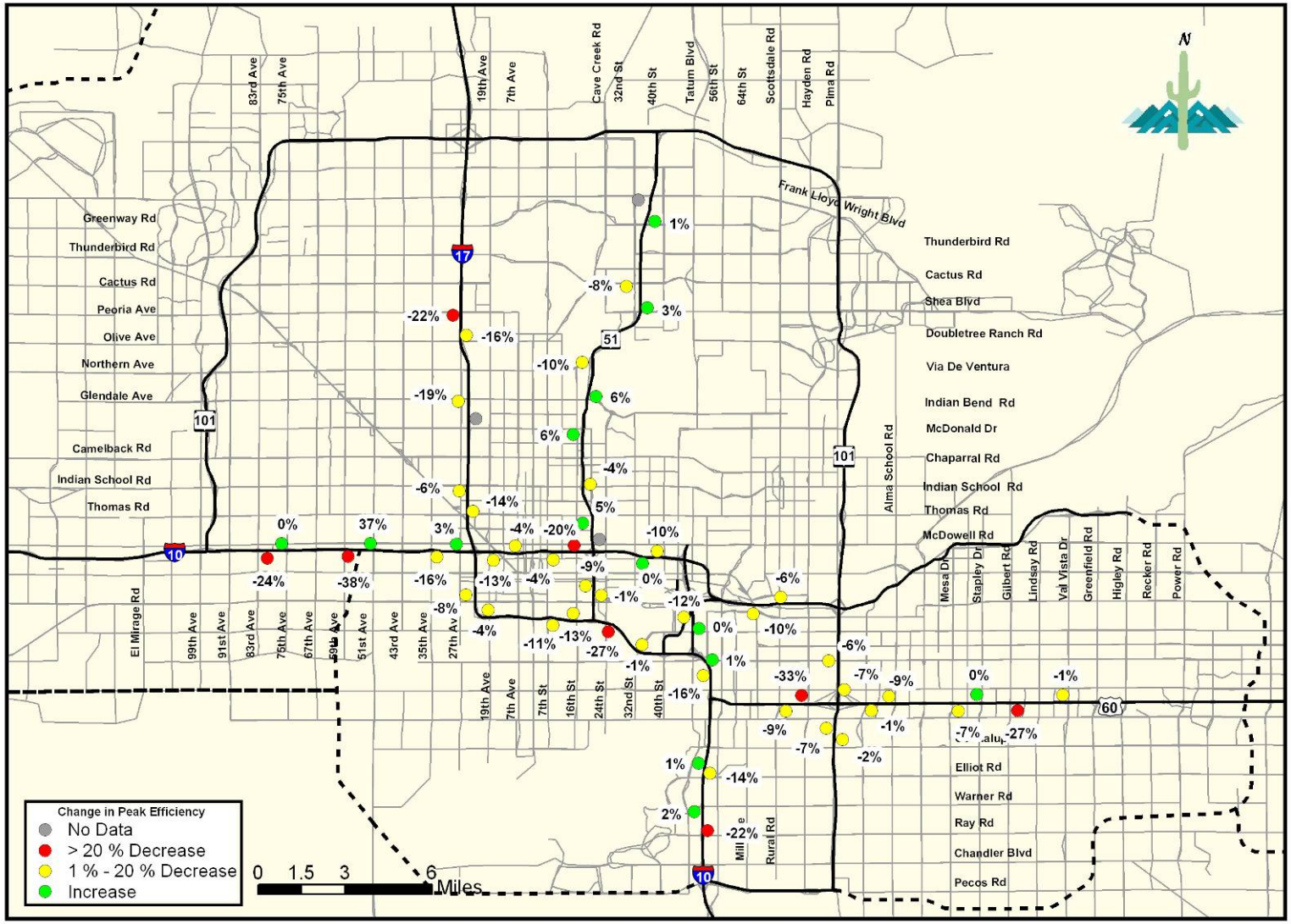

Figure 21. Change in Peak Hour Efficiency Values Based on "Lost Capacity" Concepts, 2003 to 2004

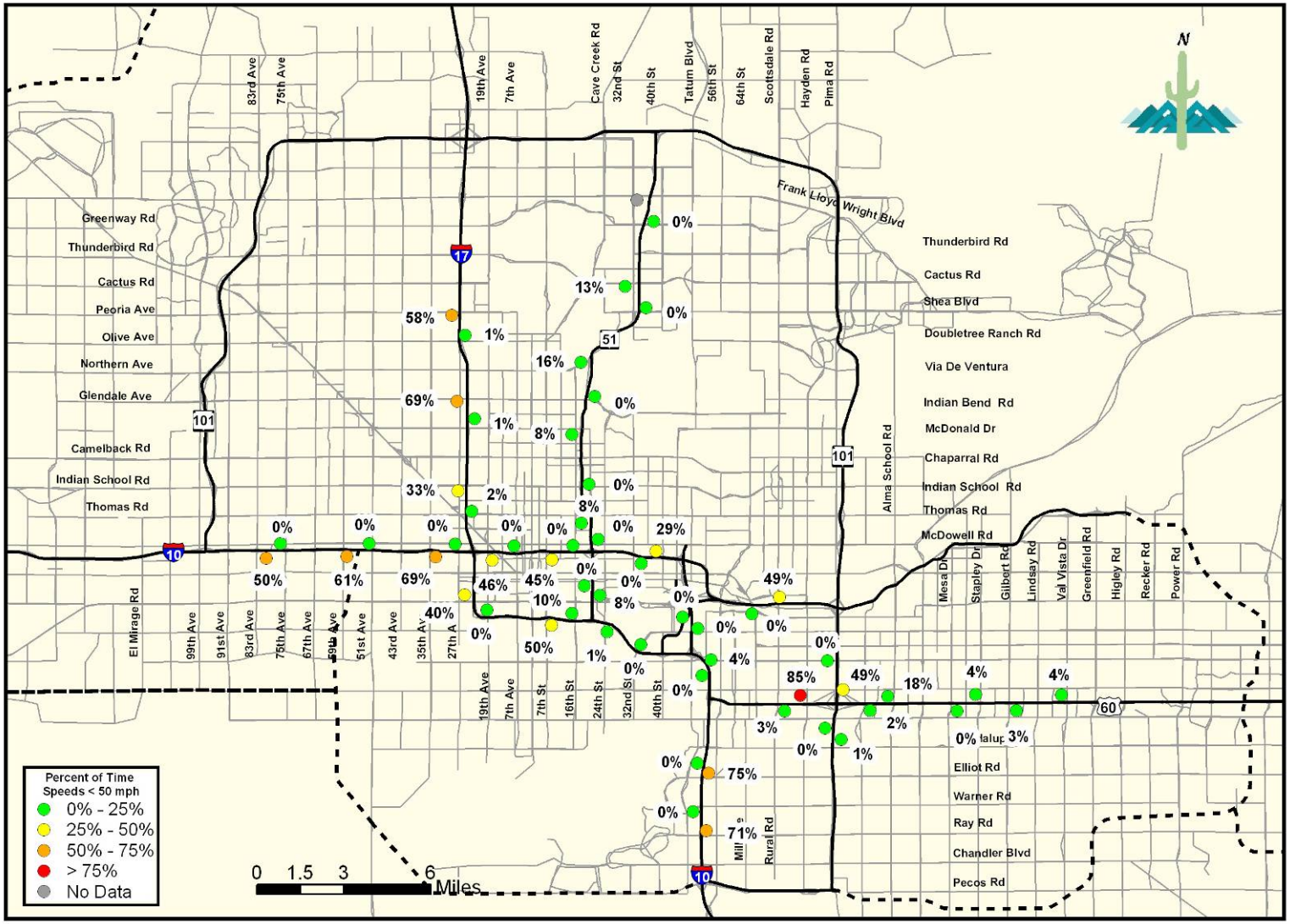

Figure 22. Percent of Weekdays with Congested Speeds, 2004 Morning Peak Period (6a-9a)

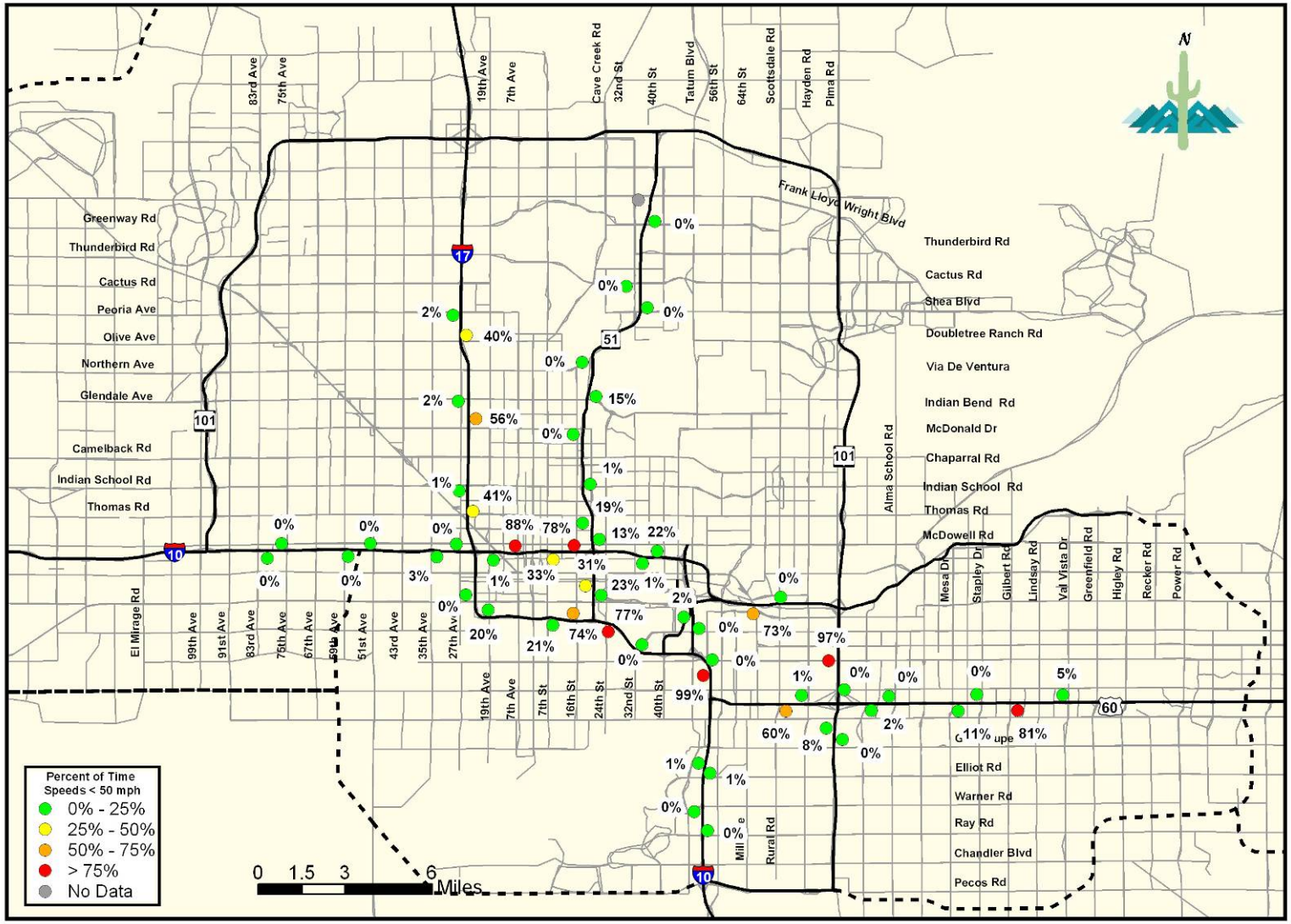

Figure 23. Percent of Weekdays with Congested Speeds, 2004 Evening Peak Period (3p-7p)

4. TRAFFIC CHARACTERISTICS

This chapter includes maps, charts, and tables that summarize traffic patterns and characteristics at the 58 TMS sites. The topics addressed in this chapter include:

- Average annual, weekday, and weekend traffic volumes
- Peak hour and directional distribution factors
- Truck traffic volumes

Analysis Parameters and Procedures

There are numerous parameters and procedures used to summarize and calculate the performance measures shown in this chapter. The following paragraphs document these parameters and procedures.

- **Average weekday statistics** do not include weekend days or Federal and Arizona State holidays.

- **Average weekend statistics** include all Saturdays and Sundays, irrespective of Federal and Arizona State holidays.

- **All average speed calculations** are weighted by vehicle volumes for that particular speed. The average speeds presented in this report are all time-mean speeds at a specific TMS site.

- **Limited imputation is used** to account for missing traffic volume data. The imputation procedure assumes that, if missing data exists for short time periods (15 minutes or less), the total vehicle volume can be calculated from the average vehicle flow rate during the time of partially missing data samples.

- **Data from auxiliary lanes** are not included in any statistics. The freeway sensor locations are typically located just upstream of entrance ramp merge areas and therefore auxiliary lanes are not present.

- **The time of the peak hour** was calculated using two different methods: 1) the single hour during the day in which average weekday traffic volumes are the highest; and 2) the single hour during the day in which average weekday travel speeds are lowest. The peak hour times are calculated for each TMS site (by freeway and direction) and are based on speeds and volumes in the freeway general purpose lanes (not including HOV lanes). A single peak hour is calculated for the entire day.

- **Free-flow speeds are estimated** by using the 85th percentile speed from all days and times during the year.

- **Vehicle-miles of travel (VMT) calculations** are based on an associated link length for each of the point sensor locations. The link length is estimated by assuming that each sensor has a zone of influence equal to half the distance to the sensors immediately upstream and downstream. The measured volumes and speeds were then assumed to be constant within this zone of influence. The estimated link lengths range from 1.7 to 4.9 miles.

- **Nearly all trend analyses are shown comparing 2004 to 2003 conditions.** The year 2003 was chosen because numerous TMS sites were activated during this year; thus, trend data for these new sites would not be available prior to 2003. Future trend analyses will encompass several years.

Free-Flow Traffic Speeds

Free-flow traffic speeds were estimated by using the 85th percentile speed from all days and times during the year. Figure 24 shows a map of free-flow traffic speeds at each of the 58 TMS sites, along with the posted speed limit.

Annual Traffic Statistics

Several annual traffic statistics were computed for the 58 TMS sites for 2004:

- Annual average daily traffic (AADT);
- Annual average weekday traffic (AAWDT); and
- Annual average weekend traffic (AAWET).

These annual statistics do include all vehicle types, including estimated truck volumes.

The following tables and figures present these annual statistics:

- Table 6 and Figure 25: AADT statistics
- Table 7 and Figure 26: AAWDT statistics
- Table 8 and Figure 27: AAWET statistics

The average annual traffic statistics were also calculated for the years 2000 through 2003. Because numerous data collection sites did not produce data prior to 2003, this year is used for trend comparisons. Figure 28 shows the percent change in weekday traffic (AAWDT) volumes from 2003 to 2004. Figure 29 shows the percent change in weekend traffic (AAWET) volumes from 2003 to 2004.

Estimated truck volumes are also available from the TMS sites in these two categories:

- Trucks with length from 30 to 55 ft.; and
- Trucks with length greater than 55 ft.

Table 9 shows the truck volumes and the estimated percent of truck traffic. Figure 30 shows a map with the truck traffic percentages for each TMS site.

Factor Statistics

Several factor statistics were computed for the 58 TMS sites for 2004:

- **Peak hour factor (PHF):** the ratio of the peak hour volume to the peak 15-minute flow rate within the peak hour. PHF values typically range from 0.80 to 0.98 on most urban freeways.

- **K-factor:** the proportion (in percent) of average daily traffic occurring in the analysis (i.e., peak) hour. The K-factor typically ranges between 8 to 10 percent on most urban freeways.

- **Directional distribution:** the proportion (in percent) of peak hour traffic in the peak direction. Directional distribution typically ranges from 50 to 65 percent on most urban freeways.

In the calculation of these factor statistics, the peak hour was defined as the single hour of the day with the highest traffic volumes.

Table 10 contains a summary of the factor statistics, and Figure 31 shows a map with the K-factors for each of the 58 TMS sites.

DVMT Estimates for the 58 TMS Sites

The AADT estimates shown in Table 6 were used in combination with the road distances between the 58 TMS sites to estimate daily vehicle-miles of travel (DVMT) since 2000. The DVMT estimates should be considered approximate only, as the traffic volumes could vary significantly on road sections between the 58 TMS sites. Since the number of TMS sites has grown from 40 to 58 sites since 2000, lane-miles are also included in the following summary of DVMT.

Statistics for 58 TMS Sites	Year				
	2000	2001	2002	2003	2004
DVMT (1000)	8,600	9,200	11,300	13,000	14,100
Lane-miles	472	482	593	736	753
DVMT per lane-mile	18,200	19,200	19,000	17,800	18,800

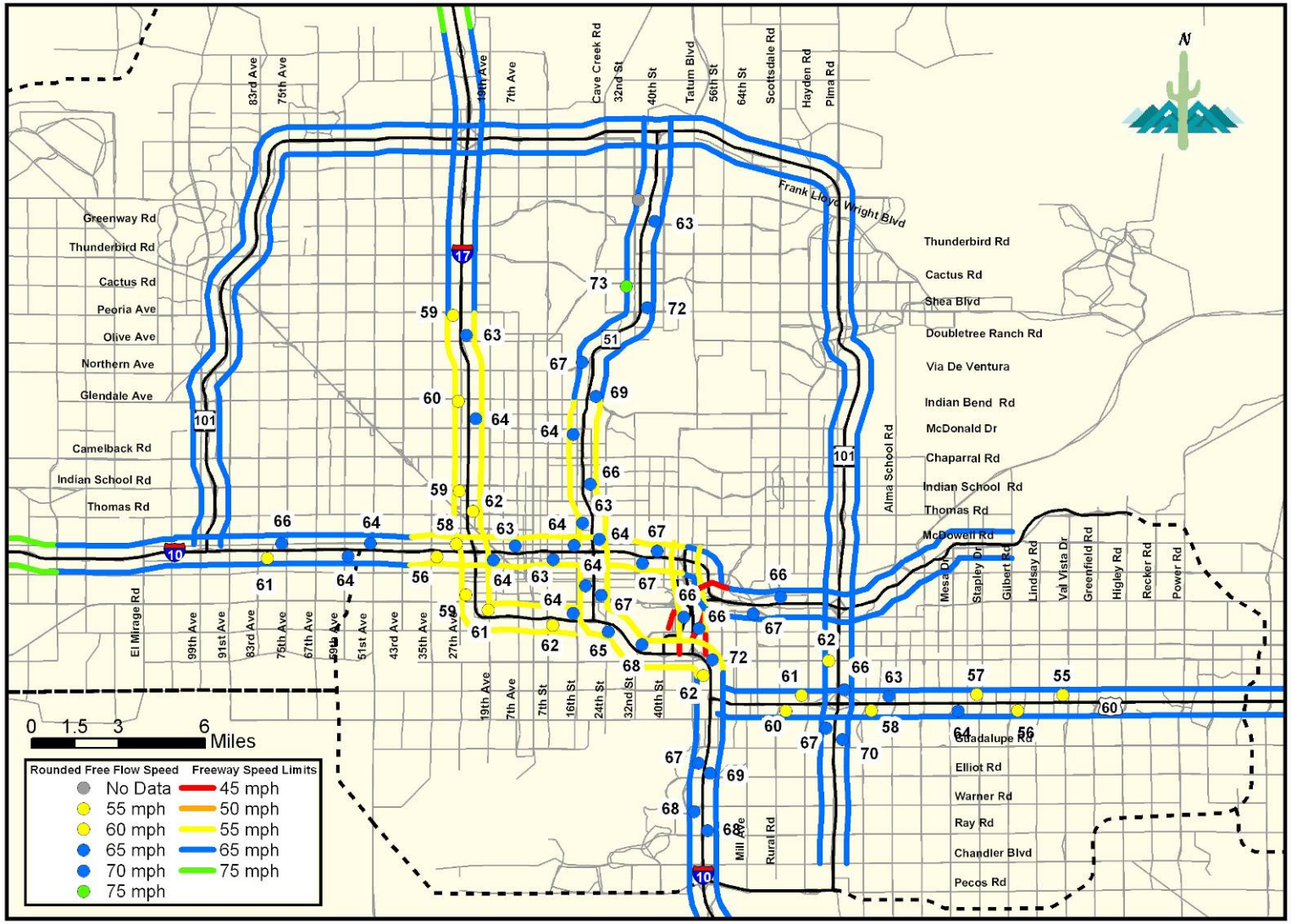

Figure 24. Estimated Free-Flow Speeds and Posted Speed Limits, 2004

Table 6. Average Annual Daily Traffic (AADT) Statistics, 2004

STN #	Location	Lanes		Freeway GP	Inside GP/HOV	Entrance Ramp	Subtotal: By Direction	Total: Both Directions
		GP	HOV					
2	I-10 EB: E of 83rd Ave	5	1	67,400	8,000	11,200	86,600	
4	I-10 WB: W of 75th Ave	4	1	53,100	11,300	5,100	69,600	156,200
20	I-10 EB: E of 59th Ave	4	1	67,400	10,100	NA	77,500	
24	I-10 WB: W of 51st Ave	4	1	78,700	11,200	6,900	96,700	174,200
68	I-10 EB: E of 35th Ave	4	1	86,600	12,300	NA	98,900	
73	I-10 WB: W of 27th Ave	5	1	59,000	11,700	5,600	76,300	175,200
75	I-10 EB: E of 19th Ave	5	1	94,400	17,300	NA	111,700	
78	I-10 WB: W of 7th Ave	4	1	109,400	20,800	11,700	141,800	253,500
85	I-10 EB: E of 7th St	4	1	95,500	21,800	NA	117,300	
139	I-10 WB: W of 16th St	6	1	127,700	NA	6,000	133,700	251,000
149	I-10 EB: S of Van Buren	3	1	60,900	7,100	5,600	73,500	
92	I-10 WB: N of Buckeye	3	1	38,400	8,900	11,000	58,300	131,800
40	I-10 EB: E of 24th St	5	1	102,700	11,800	5,900	120,400	
47	I-10 WB: W of 32nd St	5	1	92,700	11,600	11,200	115,500	235,900
64	I-10 EB: E of 48th St	5	1	102,600	15,800	NA	118,300	
66	I-10 WB: N of Southern Ave	5	1	115,800	16,300		132,000	250,300
401	I-10 EB: S of Guadalupe	4	1	91,900	7,800		99,700	
417	I-10 WB: N of Elliot	3	1	70,200	9,000	200	79,400	179,100
406	I-10 EB: S of Warner	3	1	68,600	6,100	5,200	79,900	
411	I-10 WB: S of Elliot	3	1	55,400	4,300	NA	59,700	139,600
98	I-17 NB: 16th St	3		61,500		6,600	68,200	
103	I-17 SB: E of 7th St	3		55,700		1,800	57,400	125,600
155	I-17 NB: N of Buckeye	3		59,900			59,900	
118	I-17 SB: S of Van Buren	3		61,500		4,000	65,400	125,300
337	I-17 NB: N of Thomas	3	1	72,900	7,900	4,000	84,700	
376	I-17 SB: S of Indian School	3	1	75,800	11,400	14,400	101,600	186,300
346	I-17 NB: S of Glendale	3	1	74,600	12,400	4,900	91,900	
367	I-17 SB: S of Glendale	3	1	70,800	10,600	4,300	85,600	177,500
355	I-17 NB: N of Dunlap	3	1	69,100	10,800	NA	79,900	
358	I-17 SB: S of Peoria	3	1	67,100	12,800	7,000	86,900	166,800

Table abbreviations: NB = northbound; EB = Eastbound; SB = southbound; WB = westbound; STN = station; GP = general purpose (freeway mainlanes); HOV = high-occupancy vehicle; NA = No data available

Table 6 continued on next page

Table 6. Average Annual Daily Traffic (AADT) Statistics, 2004 (Continued)

STN #	Location	Lanes		Freeway GP	Inside GP/HOV	Entrance Ramp	Subtotal: By Direction	Total: Both Directions
		GP	HOV					
264	Loop 101 NB: N of Southern	5		89,800		11,000	100,700	
261	Loop 101 SB: S of Broadway	4		95,500		11,900	107,400	208,100
514	Loop 101 NB: N of Guadalupe	4		74,300			74,300	
510	Loop 101 SB: S of Baseline	4		77,300		7,800	85,100	159,400
233	Loop 202 EB: E of 32nd St	3	1	70,700	12,500	9,000	92,100	
223	Loop 202 WB: W of 40th St	4	1	72,700	9,900	10,700	93,300	185,400
246	Loop 202 EB: W of Priest	4	1	81,700	8,900	600	91,200	
278	Loop 202 WB: W of Scottsdale	4	1	71,700	6,800	2,700	81,300	172,500
179	SR 143 NB: N of University	2		36,500		2,600	39,100	
169	SR 143 SB: S of Washington	3		35,600			35,600	74,700
203	SR 51 NB: N of McDowell	4	1	61,100	5,500	6,300	72,900	
190	SR 51 SB: S of Thomas	3	1	56,400	6,800	9,500	72,700	145,600
209	SR 51 NB: N of Indian School	3	1	56,700	6,400	14,400	77,500	
198	SR 51 SB: S of Bethany	3	1	57,500	7,000	6,600	71,100	148,600
313	SR 51 NB: N of Glendale	3	1	49,300	9,300	9,700	68,200	
294	SR 51 SB: S of Northern	4	1	40,600	5,500	6,800	52,900	121,100
325	SR 51 NB: N of Shea	3		49,800		7,400	57,200	
303	SR 51 SB: S of Cactus	3		50,000		NA	50,000	107,200
334	SR 51 NB: N of Greenway	3		38,900		6,700	45,600	
312	SR 51 SB: S of Bell	3		NA		11,200	11,200	NA
435	US 60 EB: E of Rural	3	1	70,300	10,100	3,200	83,600	
494	US 60 WB: W of McClintock	4	1	77,200	10,500	7,200	94,900	178,500
444	US 60 EB: E of Dobson	5	1	103,700	10,300	6,900	120,900	
485	US 60 WB: W of Alma School	5	1	92,400	8,200	4,300	104,900	225,800
453	US 60 EB: E of Mesa Dr	5	1	96,200	10,100	6,200	112,600	
476	US 60 WB: W of Stapley	5	1	89,100	8,400	5,200	102,800	215,400
459	US 60 EB: E of Gilbert	4	1	73,500	10,300	10,000	93,800	
467	US 60 WB: W of Val Vista	3	1	63,000	7,300	6,200	76,500	170,300

Table abbreviations: NB = northbound; EB = Eastbound; SB = southbound; WB = westbound; STN = station; GP = general purpose (freeway mainlanes); HOV = high-occupancy vehicle; NA = No data available

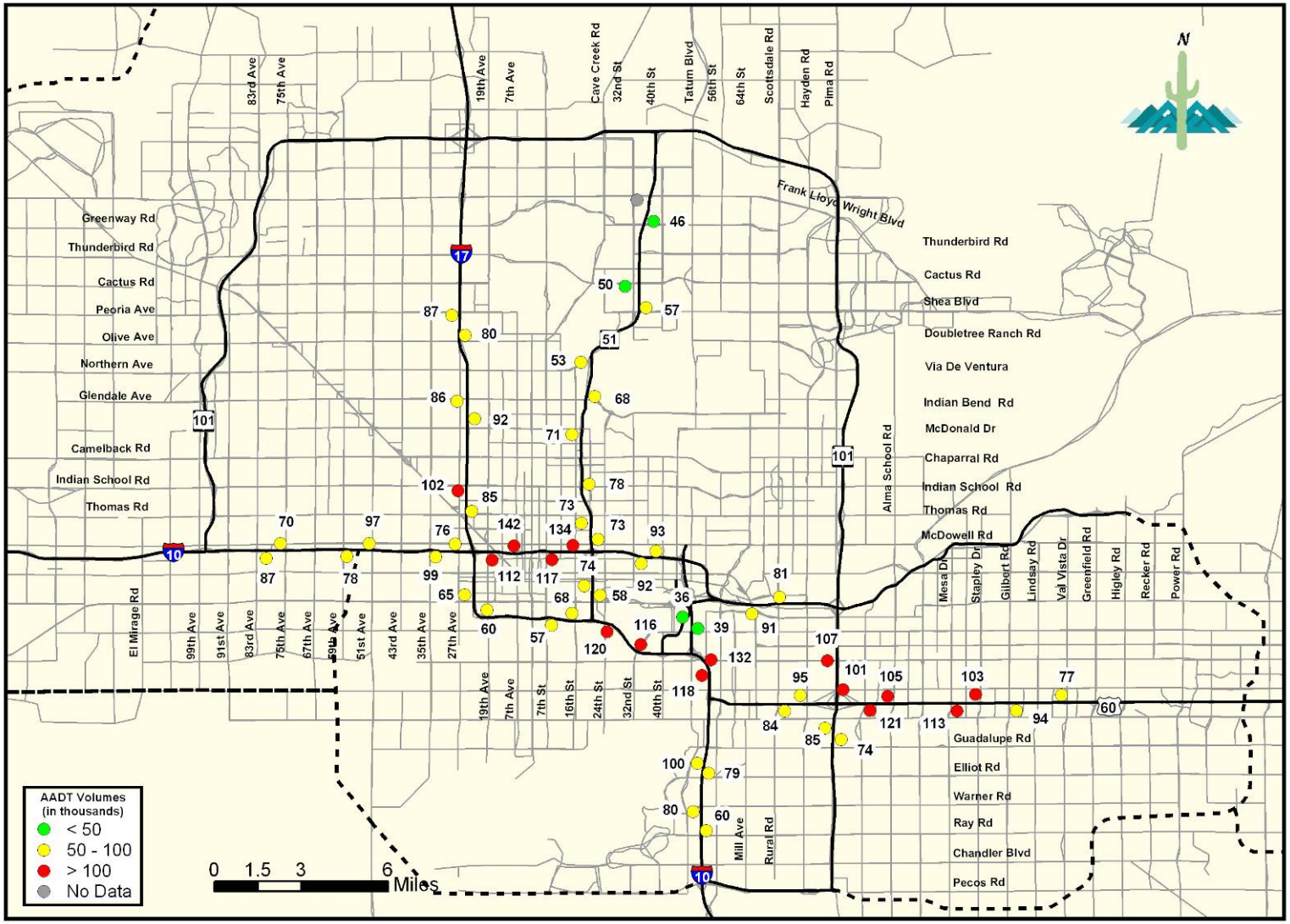

Figure 25. Average Annual Daily Traffic (AADT) Volume Statistics, 2004

Table 7. Average Annual Weekday Traffic (AAWDT) Statistics, 2004

STN #	Location	Lanes		Freeway GP	Inside GP/HOV	Entrance Ramp	Subtotal: By Direction	Total: Both Directions
		GP	HOV					
2	I-10 EB: E of 83rd Ave	5	1	72,300	8,900	11,800	93,100	
4	I-10 WB: W of 75th Ave	4	1	58,000	12,300	5,300	75,600	168,700
20	I-10 EB: E of 59th Ave	4	1	70,900	11,000	NA	82,000	
24	I-10 WB: W of 51st Ave	4	1	84,100	12,000	7,600	103,700	185,700
68	I-10 EB: E of 35th Ave	4	1	93,000	13,600	NA	106,600	
73	I-10 WB: W of 27th Ave	5	1	48,000	9,300	6,200	63,600	170,200
75	I-10 EB: E of 19th Ave	5	1	102,000	19,200	NA	121,200	
78	I-10 WB: W of 7th Ave	4	1	115,100	20,500	13,300	148,900	270,100
85	I-10 EB: E of 7th St	4	1	105,000	24,200	NA	129,200	
139	I-10 WB: W of 16th St	6	1	141,100	NA	6,100	147,100	276,300
149	I-10 EB: S of Van Buren	3	1	65,600	7,800	6,200	79,600	
92	I-10 WB: N of Buckeye	3	1	42,900	9,800	11,600	64,400	144,000
40	I-10 EB: E of 24th St	5	1	113,800	13,200	6,800	133,800	
47	I-10 WB: W of 32nd St	5	1	102,800	12,800	13,600	129,200	263,000
64	I-10 EB: E of 48th St	5	1	112,200	17,700	NA	130,000	
66	I-10 WB: N of Southern Ave	5	1	127,900	18,000		145,900	275,900
401	I-10 EB: S of Guadalupe	4	1	100,200	8,500		108,700	
417	I-10 WB: N of Elliot	3	1	74,800	10,000	100	84,900	193,600
406	I-10 EB: S of Warner	3	1	74,200	6,500	5,700	86,500	
411	I-10 WB: S of Elliot	3	1	59,000	4,900	NA	63,900	150,400
98	I-17 NB: 16th St	3		67,900		7,300	75,200	
103	I-17 SB: E of 7th St	3		61,000		2,000	62,900	138,100
155	I-17 NB: N of Buckeye	3		64,200			64,200	
118	I-17 SB: S of Van Buren	3		66,200		4,200	70,400	134,600
337	I-17 NB: N of Thomas	3	1	75,800	8,400	4,300	88,500	
376	I-17 SB: S of Indian School	3	1	80,400	11,900	15,100	107,400	195,900
346	I-17 NB: S of Glendale	3	1	78,800	13,100	5,100	97,000	
367	I-17 SB: S of Glendale	3	1	74,800	11,000	4,600	90,400	187,400
355	I-17 NB: N of Dunlap	3	1	73,600	11,400	NA	85,000	
358	I-17 SB: S of Peoria	3	1	71,900	14,000	7,500	93,300	178,300

Table abbreviations: NB = northbound; EB = Eastbound; SB = southbound; WB = westbound; STN = station; GP = general purpose (freeway mainlanes); HOV = high-occupancy vehicle; NA = No data available

Table 7 continued on next page

Table 7. Average Annual Weekday Traffic (AAWDT) Statistics, 2004 (Continued)

STN #	Location	Lanes		Freeway GP	Inside GP/HOV	Entrance Ramp	Total: by Direction	Total: Both Directions
		GP	HOV					
264	Loop 101 NB: N of Southern	5		96,900		12,000	108,900	
261	Loop 101 SB: S of Broadway	4		102,200		13,200	115,400	224,300
514	Loop 101 NB: N of Guadalupe	4		82,300			82,300	
510	Loop 101 SB: S of Baseline	4		84,500		8,500	93,000	175,300
233	Loop 202 EB: E of 32nd St	3	1	80,300	13,700	9,700	103,800	
223	Loop 202 WB: W of 40th St	4	1	81,000	11,100	11,300	103,400	207,200
246	Loop 202 EB: W of Priest	4	1	90,400	10,200	700	101,300	
278	Loop 202 WB: W of Scottsdale	4	1	80,100	7,800	2,900	90,800	192,100
179	SR 143 NB: N of University	2		40,200		3,100	43,300	
169	SR 143 SB: S of Washington	3		41,300			41,300	84,600
203	SR 51 NB: N of McDowell	4	1	67,600	6,000	6,900	80,500	
190	SR 51 SB: S of Thomas	3	1	63,400	7,000	10,700	81,100	161,600
209	SR 51 NB: N of Indian School	3	1	63,300	7,300	15,500	86,000	
198	SR 51 SB: S of Bethany	3	1	64,000	8,200	7,200	79,300	165,300
313	SR 51 NB: N of Glendale	3	1	56,600	10,600	11,100	78,400	
294	SR 51 SB: S of Northern	4	1	45,600	6,400	7,500	59,500	137,900
325	SR 51 NB: N of Shea	3		57,000		8,000	65,000	
303	SR 51 SB: S of Cactus	3		56,800		NA	56,800	121,800
334	SR 51 NB: N of Greenway	3		43,800		7,000	50,800	
312	SR 51 SB: S of Bell	3		NA		12,200	12,200	NA
435	US 60 EB: E of Rural	3	1	74,300	11,100	3,400	88,900	
494	US 60 WB: W of McClintock	4	1	82,600	11,700	7,600	101,900	190,800
444	US 60 EB: E of Dobson	5	1	111,900	11,100	7,800	130,800	
485	US 60 WB: W of Alma School	5	1	99,100	9,200	4,600	112,900	243,700
453	US 60 EB: E of Mesa Dr	5	1	103,000	11,000	6,800	120,800	
476	US 60 WB: W of Stapley	5	1	96,100	9,100	5,500	110,600	231,400
459	US 60 EB: E of Gilbert	4	1	77,900	11,200	10,000	99,100	
467	US 60 WB: W of Val Vista	3	1	67,300	7,800	6,600	81,700	180,800

Table abbreviations: NB = northbound; EB = Eastbound; SB = southbound; WB = westbound; STN = station; GP = general purpose (freeway mainlanes); HOV = high-occupancy vehicle; NA = No data available

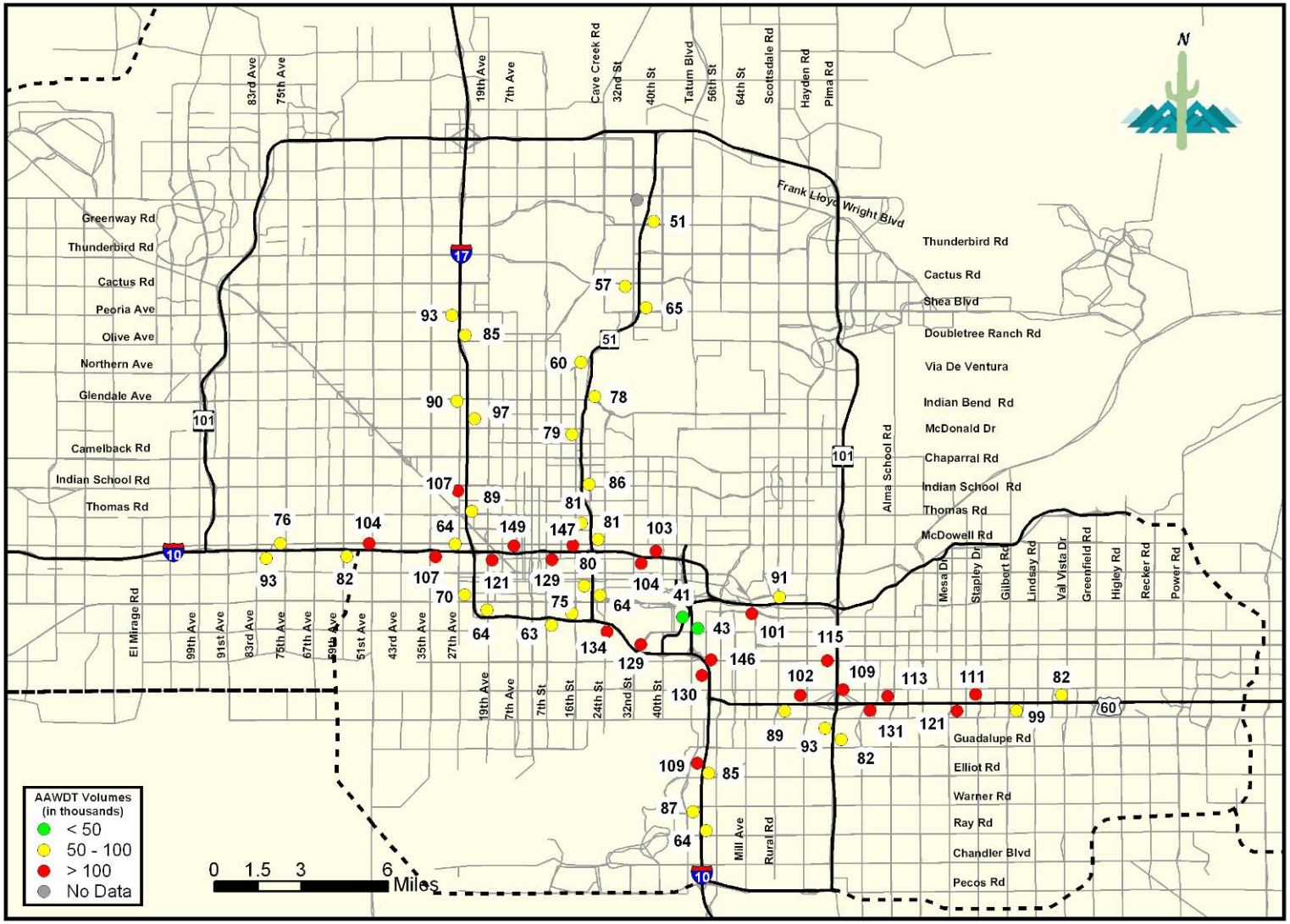

Figure 26. Average Annual Weekday Traffic (AAWDT) Volume Statistics, 2004

Table 8. Average Annual Weekend Traffic (AAWET) Statistics, 2004

STN #	Location	Lanes		Freeway GP	Inside GP/HOV	Entrance Ramp	Total: by Direction	Total: Both Directions
		GP	HOV					
2	I-10 EB: E of 83rd Ave	5	1	55,100	5,800	9,500	70,400	124,900
4	I-10 WB: W of 75th Ave	4	1	41,000	9,000	4,600	54,500	
20	I-10 EB: E of 59th Ave	4	1	58,600	7,800	NA	66,500	145,800
24	I-10 WB: W of 51st Ave	4	1	65,200	9,000	5,100	79,300	
68	I-10 EB: E of 35th Ave	4	1	70,800	9,000	NA	79,800	194,500
73	I-10 WB: W of 27th Ave	5	1	92,000	18,700	4,100	114,700	
75	I-10 EB: E of 19th Ave	5	1	75,300	12,800	NA	88,100	211,200
78	I-10 WB: W of 7th Ave	4	1	94,200	21,400	7,600	123,100	
85	I-10 EB: E of 7th St	4	1	72,000	15,700	NA	87,700	187,700
139	I-10 WB: W of 16th St	6	1	94,300	NA	5,700	100,000	
149	I-10 EB: S of Van Buren	3	1	47,600	5,000	4,100	56,700	99,100
92	I-10 WB: N of Buckeye	3	1	27,000	5,900	9,500	42,400	
40	I-10 EB: E of 24th St	5	1	75,000	8,400	3,600	86,900	168,300
47	I-10 WB: W of 32nd St	5	1	67,600	8,600	5,200	81,400	
64	I-10 EB: E of 48th St	5	1	78,500	10,800	NA	89,300	186,700
66	I-10 WB: N of Southern Ave	5	1	85,400	12,000		97,400	
401	I-10 EB: S of Guadalupe	4	1	71,200	5,900		77,100	142,700
417	I-10 WB: N of Elliot	3	1	59,000	6,400	300	65,600	
406	I-10 EB: S of Warner	3	1	54,700	4,900	3,900	63,600	113,000
411	I-10 WB: S of Elliot	3	1	46,700	2,800	NA	49,400	
98	I-17 NB: 16th St	3		45,600		5,000	50,700	93,900
103	I-17 SB: E of 7th St	3		42,000		1,200	43,200	
155	I-17 NB: N of Buckeye	3		49,100			49,100	102,000
118	I-17 SB: S of Van Buren	3		49,600		3,300	52,900	
337	I-17 NB: N of Thomas	3	1	65,600	6,800	3,000	75,400	162,400
376	I-17 SB: S of Indian School	3	1	64,200	10,300	12,600	87,000	
346	I-17 NB: S of Glendale	3	1	64,000	10,700	4,200	78,900	152,600
367	I-17 SB: S of Glendale	3	1	60,700	9,400	3,600	73,700	
355	I-17 NB: N of Dunlap	3	1	58,000	9,200	NA	67,200	138,100
358	I-17 SB: S of Peoria	3	1	55,300	9,700	5,900	70,900	

Table abbreviations: NB = northbound; EB = Eastbound; SB = southbound; WB = westbound; STN = station; GP = general purpose (freeway mainlanes); HOV = high-occupancy vehicle; NA = No data available

Table 8 continued on next page

Table 8. Average Annual Weekend Traffic (AAWET) Statistics, 2004 (Continued)

STN #	Location	Lanes		Freeway GP	Inside GP/HOV	Entrance Ramp	Total: by Direction	Total: Both Directions
		GP	HOV					
264	Loop 101 NB: N of Southern	5		72,200		8,500	80,800	168,500
261	Loop 101 SB: S of Broadway	4		78,800		8,900	87,700	
514	Loop 101 NB: N of Guadalupe	4		54,100			54,100	119,400
510	Loop 101 SB: S of Baseline	4		59,200		6,100	65,300	
233	Loop 202 EB: E of 32nd St	3	1	46,600	9,300	7,000	62,900	131,100
223	Loop 202 WB: W of 40th St	4	1	51,900	7,000	9,300	68,200	
246	Loop 202 EB: W of Priest	4	1	60,100	5,700	200	66,000	123,500
278	Loop 202 WB: W of Scottsdale	4	1	50,900	4,300	2,300	57,500	
179	SR 143 NB: N of University	2		27,200		1,400	28,600	50,000
169	SR 143 SB: S of Washington	3		21,400			21,400	
203	SR 51 NB: N of McDowell	4	1	43,600	4,100	4,600	52,300	104,200
190	SR 51 SB: S of Thomas	3	1	38,700	6,500	6,700	51,900	
209	SR 51 NB: N of Indian School	3	1	40,500	4,100	11,500	56,100	105,200
198	SR 51 SB: S of Bethany	3	1	40,000	3,900	5,200	49,100	
313	SR 51 NB: N of Glendale	3	1	30,600	5,800	6,200	42,500	79,000
294	SR 51 SB: S of Northern	4	1	28,200	3,400	4,900	36,500	
325	SR 51 NB: N of Shea	3		31,800		6,100	37,900	70,400
303	SR 51 SB: S of Cactus	3		32,500		NA	32,500	
334	SR 51 NB: N of Greenway	3		26,400		5,900	32,300	NA
312	SR 51 SB: S of Bell	3		NA		8,500	8,500	
435	US 60 EB: E of Rural	3	1	60,100	7,700	2,600	70,400	147,700
494	US 60 WB: W of McClintock	4	1	63,500	7,600	6,200	77,300	
444	US 60 EB: E of Dobson	5	1	83,100	8,400	4,700	96,200	181,200
485	US 60 WB: W of Alma School	5	1	75,600	5,900	3,500	85,000	
453	US 60 EB: E of Mesa Dr	5	1	79,700	8,000	4,600	92,300	175,400
476	US 60 WB: W of Stapley	5	1	71,700	6,900	4,600	83,100	
459	US 60 EB: E of Gilbert	4	1	62,500	8,200	9,900	80,600	144,100
467	US 60 WB: W of Val Vista	3	1	52,200	6,000	5,300	63,500	

Table abbreviations: NB = northbound; EB = Eastbound; SB = southbound; WB = westbound; STN = station; GP = general purpose (freeway mainlanes); HOV = high-occupancy vehicle; NA = No data available

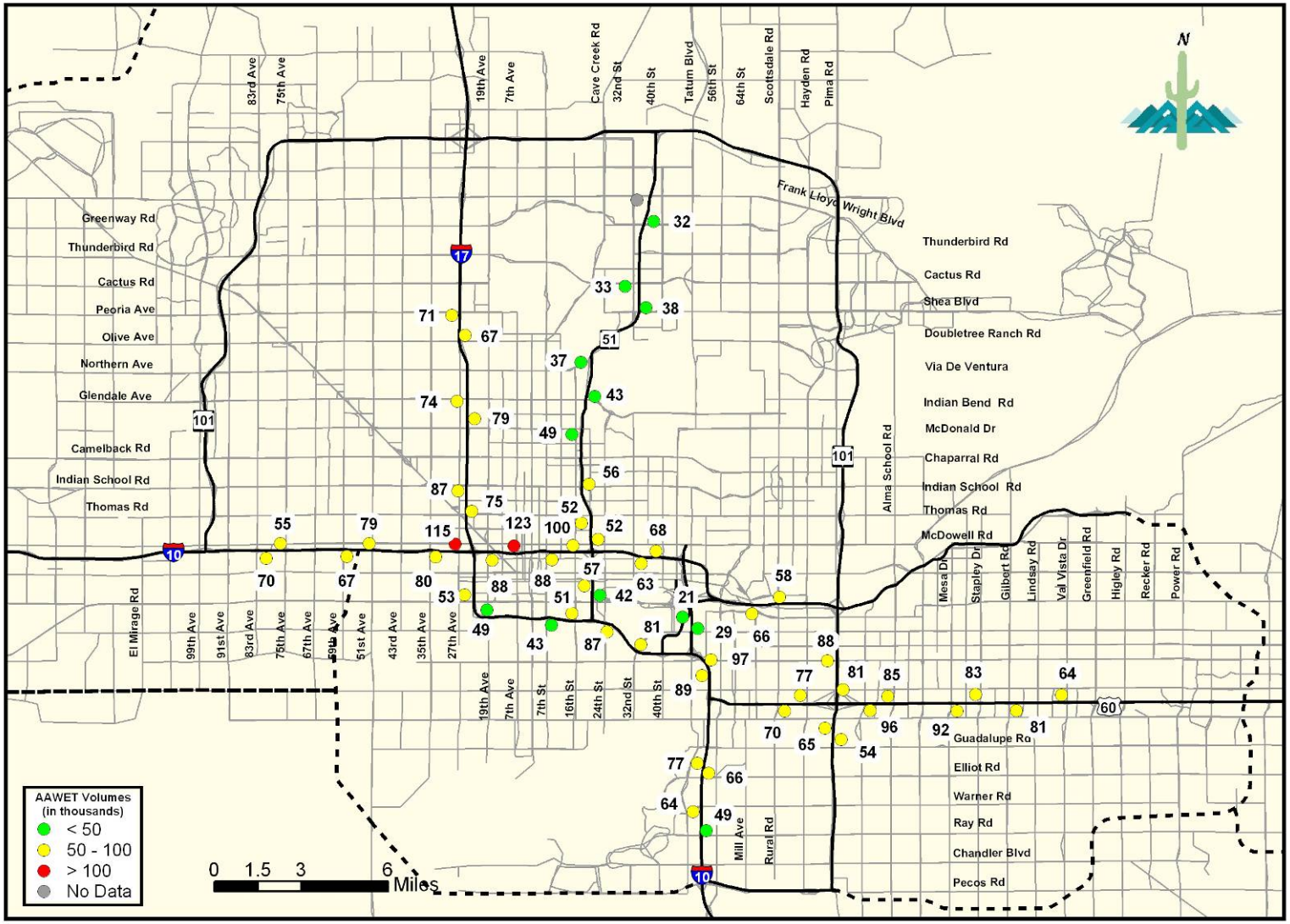

Figure 27. Average Annual Weekend Traffic (AAWET) Volume Statistics, 2004

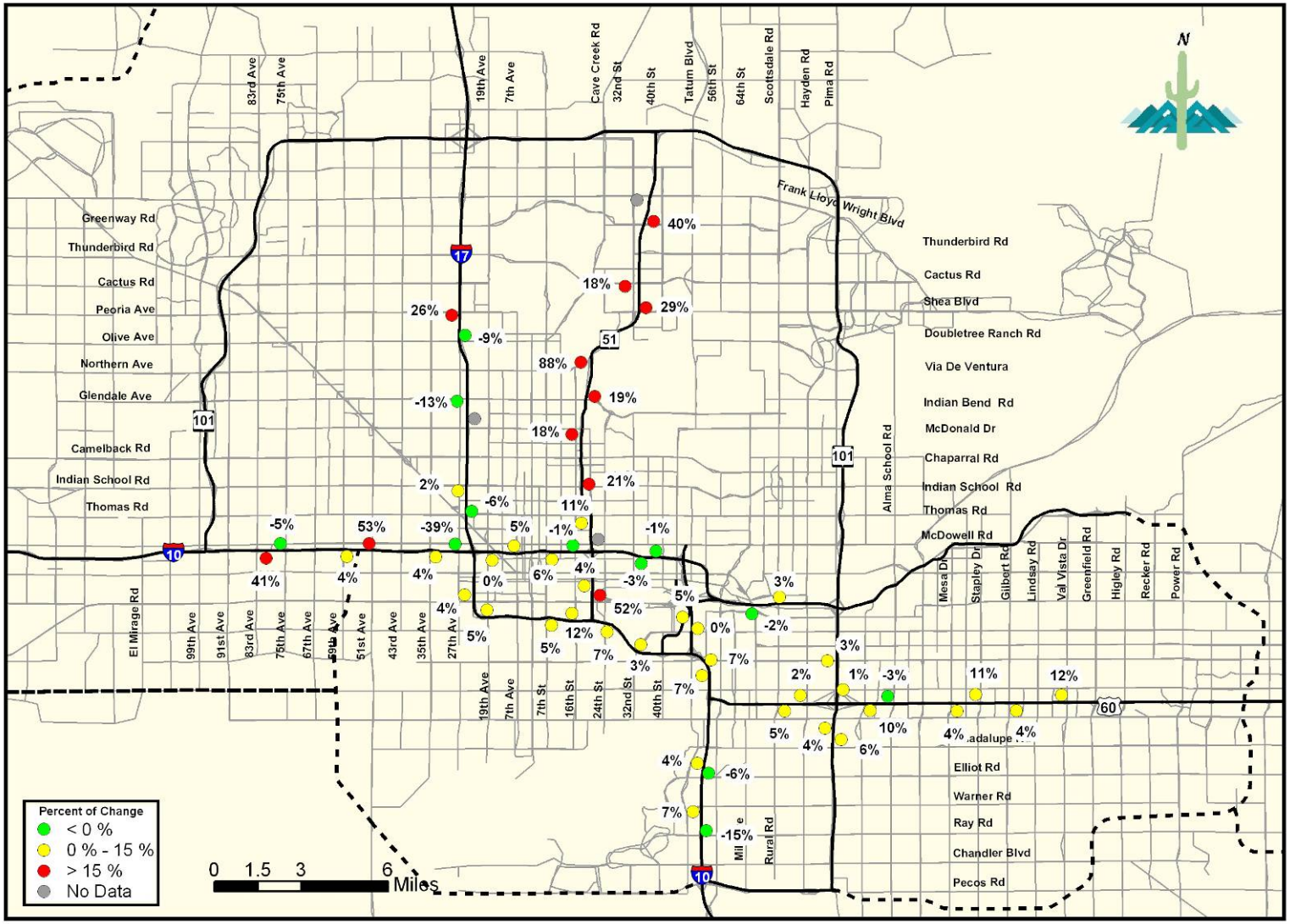

Figure 28. Percent Change in Weekday Traffic (AAWDT) Volume Statistics, 2003 to 2004

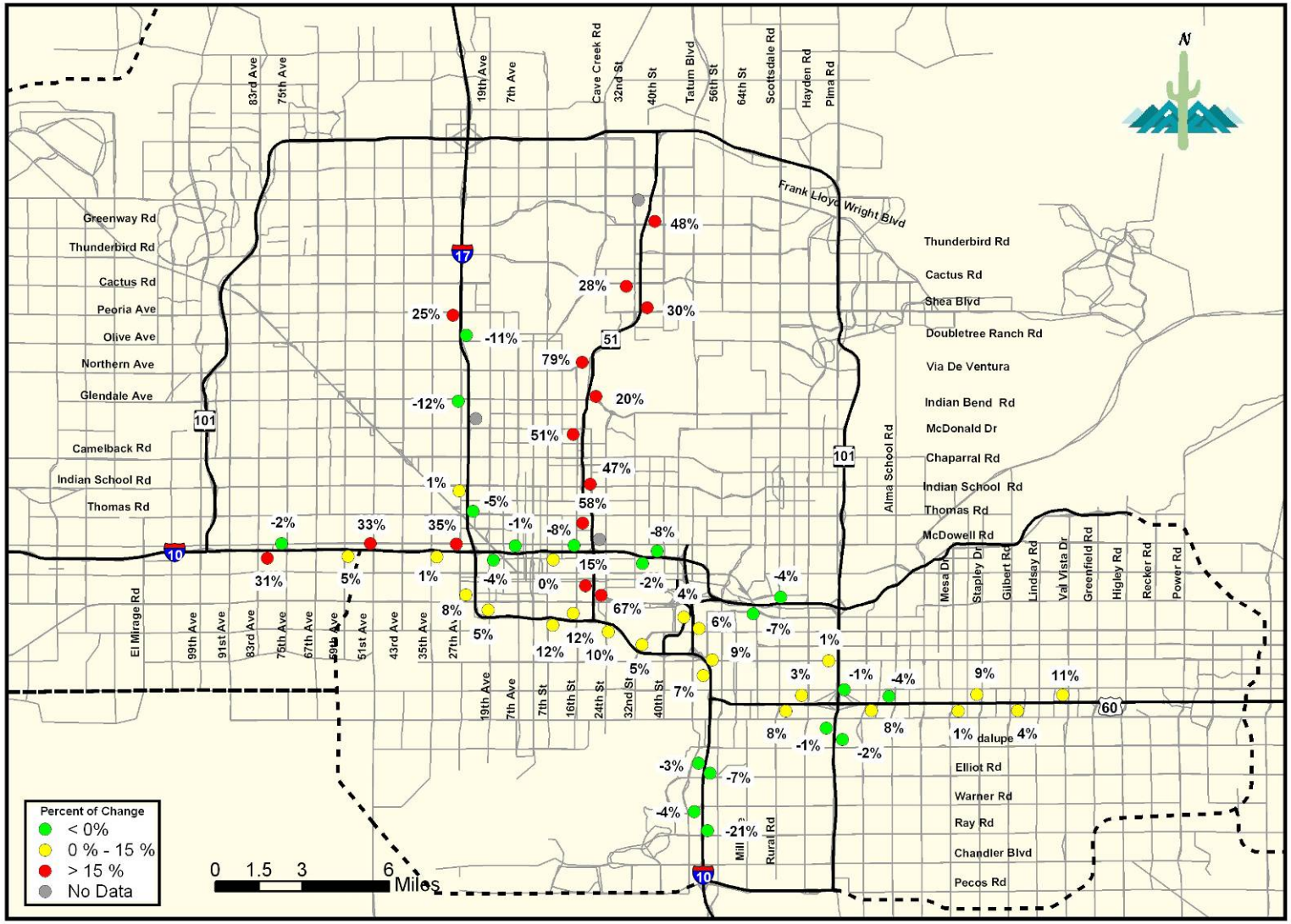

Figure 29. Percent Change in Weekend Traffic (AAWET) Volume Statistics, 2003 to 2004

Table 9. Average Annual Truck Traffic Statistics, 2004

STN #	Location	AADT – all days				AAWET –weekend days only			
		30-55 ft	> 55 ft	All trucks	Truck %	30-55 ft	> 55 ft	All trucks	Truck %
2	I-10 EB: E of 83rd Ave	3,660	30	3,700	4%	2,530	10	2,540	4%
4	I-10 WB: W of 75th Ave	4,060	180	4,240	6%	2,790	110	2,910	5%
20	I-10 EB: E of 59th Ave	7,140	610	7,740	10%	4,440	240	4,680	7%
24	I-10 WB: W of 51st Ave	9,340	1,850	11,190	12%	5,450	1,100	6,550	8%
68	I-10 EB: E of 35th Ave	11,400	1,110	12,510	13%	7,090	610	7,700	10%
73	I-10 WB: W of 27th Ave	7,730	0	7,730	10%	11,580	0	11,580	10%
75	I-10 EB: E of 19th Ave	4,700	1,060	5,770	5%	2,680	680	3,360	4%
78	I-10 WB: W of 7th Ave	20,140	2,700	22,830	16%	18,370	2,780	21,150	17%
85	I-10 EB: E of 7th St	2,610	2,610	5,220	4%	1,310	1,430	2,750	3%
139	I-10 WB: W of 16th St	3,140	2,490	5,620	4%	1,520	1,390	2,910	3%
149	I-10 EB: S of Van Buren	2,050	3,780	5,840	8%	1,160	3,250	4,410	8%
92	I-10 WB: N of Buckeye	5,940	14,530	20,470	35%	4,240	12,400	16,640	39%
40	I-10 EB: E of 24th St	3,650	4,530	8,180	7%	1,700	2,630	4,320	5%
47	I-10 WB: W of 32nd St	5,770	6,320	12,090	10%	3,470	4,050	7,520	9%
64	I-10 EB: E of 48th St	3,280	5,200	8,480	7%	1,650	3,160	4,820	5%
66	I-10 WB: N of Southern Ave	4,390	6,050	10,440	8%	2,320	4,720	7,040	7%
401	I-10 EB: S of Guadalupe	1,620	2,600	4,210	4%	950	1,660	2,620	3%
417	I-10 WB: N of Elliot	2,570	3,800	6,380	8%	1,420	2,610	4,030	6%
406	I-10 EB: S of Warner	1,950	1,700	3,650	5%	1,190	1,120	2,320	4%
411	I-10 WB: S of Elliot	1,840	3,490	5,340	9%	1,000	2,400	3,410	7%
98	I-17 NB: 16th St	2,660	3,210	5,870	9%	1,120	1,820	2,930	6%
103	I-17 SB: E of 7th St	7,430	4,560	12,000	21%	6,520	3,090	9,610	22%
155	I-17 NB: N of Buckeye	2,070	3,220	5,290	9%	900	1,910	2,810	6%
118	I-17 SB: S of Van Buren	1,710	1,800	3,510	5%	760	1,020	1,780	3%
337	I-17 NB: N of Thomas	3,290	450	3,750	4%	2,040	300	2,340	3%
376	I-17 SB: S of Indian School	4,060	400	4,460	4%	2,620	270	2,890	3%
346	I-17 NB: S of Glendale	5,000	660	5,660	6%	3,510	450	3,960	5%
367	I-17 SB: S of Glendale	2,610	210	2,820	3%	1,710	130	1,840	2%
355	I-17 NB: N of Dunlap	4,090	400	4,490	6%	2,610	240	2,850	4%
358	I-17 SB: S of Peoria	3,680	2,210	5,890	7%	2,340	2,070	4,410	6%

Table abbreviations: NB = northbound; EB = Eastbound; SB = southbound; WB = westbound; STN = station; NA = No data available

Table 9 continued on next page

Table 9. Average Annual Truck Traffic Statistics, 2004 (Continued)

STN #	Location	AADT – all days				AAWET –weekend days only			
		30-55 ft	> 55 ft	All trucks	Truck %	30-55 ft	> 55 ft	All trucks	Truck %
264	Loop 101 NB: N of Southern	660	80	730	1%	410	30	440	1%
261	Loop 101 SB: S of Broadway	810	100	920	1%	540	40	580	1%
514	Loop 101 NB: N of Guadalupe	13,340	1,080	14,420	19%	10,470	550	11,010	20%
510	Loop 101 SB: S of Baseline	11,830	710	12,540	15%	9,670	370	10,040	15%
233	Loop 202 EB: E of 32nd St	1,810	990	2,800	3%	790	450	1,240	2%
223	Loop 202 WB: W of 40th St	1,660	760	2,420	3%	770	330	1,090	2%
246	Loop 202 EB: W of Priest	1,080	370	1,450	2%	540	160	700	1%
278	Loop 202 WB: W of Scottsdale	1,060	290	1,350	2%	500	120	620	1%
179	SR 143 NB: N of University	850	150	1,000	3%	420	80	510	2%
169	SR 143 SB: S of Washington	800	230	1,030	3%	300	110	410	2%
203	SR 51 NB: N of McDowell	3,000	90	3,090	4%	1,090	20	1,120	2%
190	SR 51 SB: S of Thomas	5,200	390	5,600	8%	3,640	240	3,880	7%
209	SR 51 NB: N of Indian School	1,180	20	1,200	2%	560	10	570	1%
198	SR 51 SB: S of Bethany	930	710	1,640	2%	280	550	830	2%
313	SR 51 NB: N of Glendale	1,050	1,720	2,770	4%	360	1,610	1,970	5%
294	SR 51 SB: S of Northern	590	80	660	1%	250	30	280	1%
325	SR 51 NB: N of Shea	620	160	770	1%	270	60	330	1%
303	SR 51 SB: S of Cactus	910	180	1,090	2%	400	70	470	1%
334	SR 51 NB: N of Greenway	550	120	680	1%	240	40	290	1%
312	SR 51 SB: S of Bell	NA	NA	NA	NA	NA	NA	NA	NA
435	US 60 EB: E of Rural	2,880	120	3,000	4%	1,640	50	1,690	2%
494	US 60 WB: W of McClintock	1,490	50	1,540	2%	730	10	740	1%
444	US 60 EB: E of Dobson	1,740	40	1,780	1%	860	20	880	1%
485	US 60 WB: W of Alma School	6,100	1,880	7,980	8%	4,370	1,550	5,920	7%
453	US 60 EB: E of Mesa Dr	1,370	20	1,400	1%	750	10	760	1%
476	US 60 WB: W of Stapley	1,030	20	1,050	1%	520	10	540	1%
459	US 60 EB: E of Gilbert	640	20	660	1%	260	10	270	0%
467	US 60 WB: W of Val Vista	1,410	220	1,630	2%	710	210	920	1%
264	Loop 101 NB: N of Southern	660	80	730	1%	410	30	440	1%
261	Loop 101 SB: S of Broadway	810	100	920	1%	540	40	580	1%

Table abbreviations: NB = northbound; EB = Eastbound; SB = southbound; WB = westbound; STN = station; NA = No data available

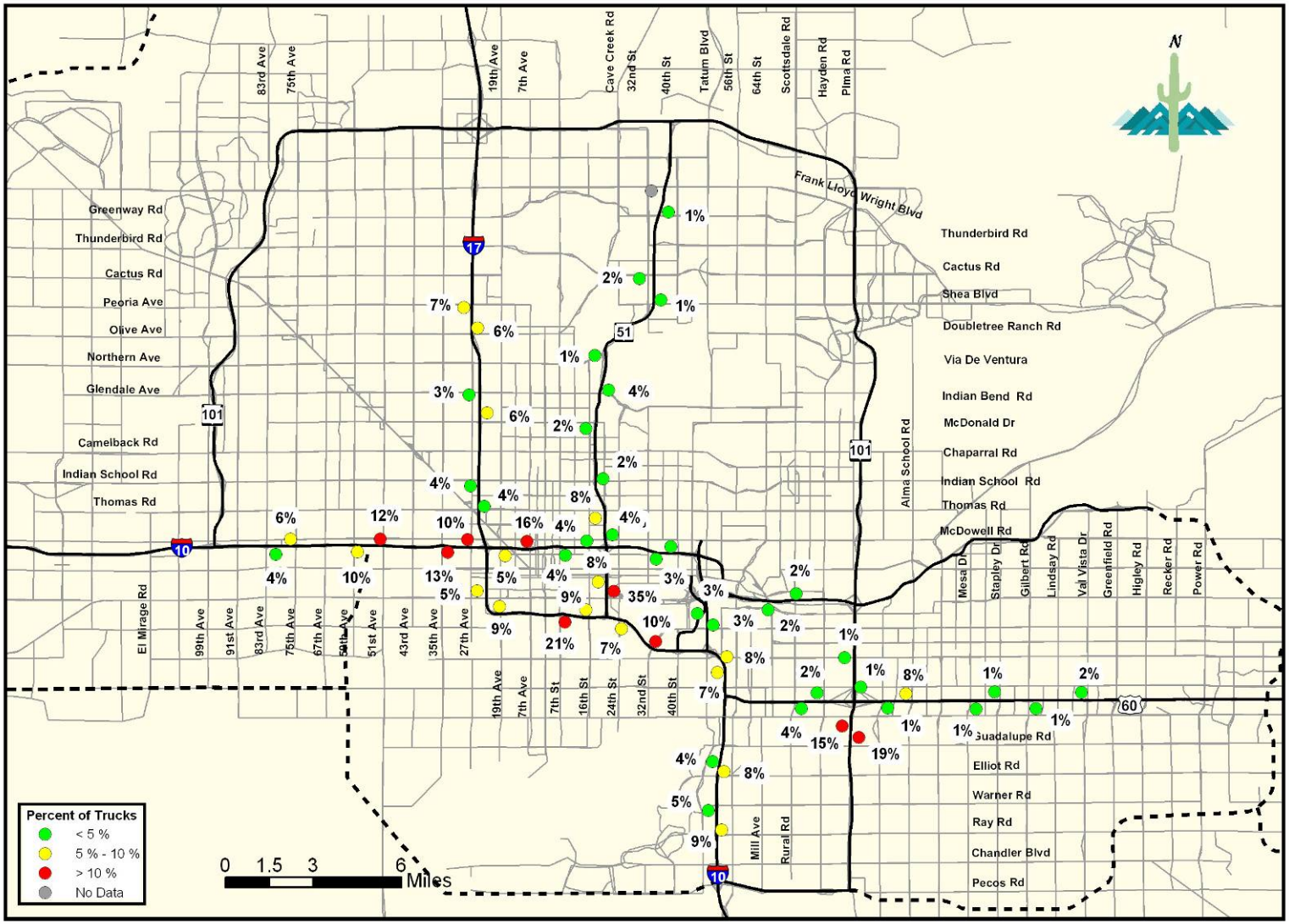

Figure 30. Estimated Truck Traffic Percentage based on AADT, 2004

Table 10. Peak Hour Factor and Directional Distribution Statistics, 2004

STN #	Location	Peak Hour Start Time	Peak Hour Factor (PHF)	K-Factor (%)	Peak Hour Volume (both directions)	Directional Distribution (%)
2	I-10 EB: E of 83rd Ave	2:30 PM	0.94	7.8%	11,290	53%
4	I-10 WB: W of 75th Ave		0.99	7.6%		
20	I-10 EB: E of 59th Ave	3:30 PM	0.95	6.2%	12,420	63%
24	I-10 WB: W of 51st Ave		0.99	7.5%		
68	I-10 EB: E of 35th Ave	3:15 PM	0.99	6.4%	16,160	62%
73	I-10 WB: W of 27th Ave		0.98	15.8%		
75	I-10 EB: E of 19th Ave	7:00 AM	0.99	7.0%	16,450	53%
78	I-10 WB: W of 7th Ave		0.98	6.3%		
85	I-10 EB: E of 7th St	2:00 PM	0.99	7.0%	18,820	56%
139	I-10 WB: W of 16th St		0.95	7.2%		
149	I-10 EB: S of Van Buren	7:00 AM	0.84	6.4%	12,400	53%
92	I-10 WB: N of Buckeye		0.97	10.8%		
40	I-10 EB: E of 24th St	3:15 PM	0.98	7.2%	19,260	50%
47	I-10 WB: W of 32nd St		0.97	7.9%		
64	I-10 EB: E of 48th St	2:30 PM	0.97	7.5%	19,030	52%
66	I-10 WB: N of Southern Ave		0.99	8.4%		
401	I-10 EB: S of Guadalupe	4:30 PM	0.99	7.8%	13,740	63%
417	I-10 WB: N of Elliot		0.94	7.5%		
406	I-10 EB: S of Warner	4:30 PM	0.99	8.0%	11,080	65%
411	I-10 WB: S of Elliot		0.87	7.6%		
98	I-17 NB: 16th St	7:00 AM	0.98	7.2%	9,660	54%
103	I-17 SB: E of 7th St		0.98	7.1%		
155	I-17 NB: N of Buckeye	2:45 PM	0.99	7.7%	9,360	52%
118	I-17 SB: S of Van Buren		0.93	7.3%		
337	I-17 NB: N of Thomas	2:15 PM	0.98	6.0%	12,190	53%
376	I-17 SB: S of Indian School		0.98	6.3%		
346	I-17 NB: S of Glendale	2:15 PM	0.99	6.0%	11,920	53%
367	I-17 SB: S of Glendale		0.99	6.4%		
355	I-17 NB: N of Dunlap	2:15 PM	0.99	6.6%	11,600	51%
358	I-17 SB: S of Peoria		0.94	6.4%		

Table abbreviations: NB = northbound; EB = Eastbound; SB = southbound; WB = westbound; STN = station; NA = No data available

Table 10 continued on next page

Table 10. Peak Hour Factor and Directional Distribution Statistics, 2004 (Continued)

STN #	Location	Peak Hour Start Time	Peak Hour Factor (PHF)	K-Factor (%)	Peak Hour Volume (both directions)	Directional Distribution (%)
264	Loop 101 NB: N of Southern	4:30 PM	0.97	7.9%	15,280	55%
261	Loop 101 SB: S of Broadway		0.99	7.4%		
514	Loop 101 NB: N of Guadalupe	4:45 PM	0.98	7.9%	13,570	56%
510	Loop 101 SB: S of Baseline		0.99	8.2%		
233	Loop 202 EB: E of 32nd St	2:30 PM	0.98	7.5%	14,280	50%
223	Loop 202 WB: W of 40th St		0.97	7.7%		
246	Loop 202 EB: W of Priest	2:30 PM	0.99	7.8%	13,070	60%
278	Loop 202 WB: W of Scottsdale		0.97	9.6%		
179	SR 143 NB: N of University	7:15 AM	0.95	8.7%	7,350	51%
169	SR 143 SB: S of Washington		0.85	9.0%		
203	SR 51 NB: N of McDowell	3:15 PM	0.99	8.0%	12,040	54%
190	SR 51 SB: S of Thomas		0.97	7.9%		
209	SR 51 NB: N of Indian School	3:30 PM	0.99	8.1%	12,020	57%
198	SR 51 SB: S of Bethany		0.93	8.7%		
313	SR 51 NB: N of Glendale	4:15 PM	0.98	9.2%	11,070	67%
294	SR 51 SB: S of Northern		0.97	9.6%		
325	SR 51 NB: N of Shea	4:45 PM	0.99	10.3%	10,190	65%
303	SR 51 SB: S of Cactus		0.95	9.9%		
334	SR 51 NB: N of Greenway	4:45 PM	0.97	10.0%	NA	NA
312	SR 51 SB: S of Bell		NA	NA		
435	US 60 EB: E of Rural	2:15 PM	0.99	7.1%	13,230	51%
494	US 60 WB: W of McClintock		0.95	7.0%		
444	US 60 EB: E of Dobson	4:30 PM	0.99	7.5%	16,830	60%
485	US 60 WB: W of Alma School		0.96	7.6%		
453	US 60 EB: E of Mesa Dr	4:30 PM	0.99	7.6%	15,240	61%
476	US 60 WB: W of Stapley		0.99	8.0%		
459	US 60 EB: E of Gilbert	2:15 PM	0.99	6.7%	11,770	58%
467	US 60 WB: W of Val Vista		0.98	7.4%		

Table abbreviations: NB = northbound; EB = Eastbound; SB = southbound; WB = westbound; STN = station; NA = No data available

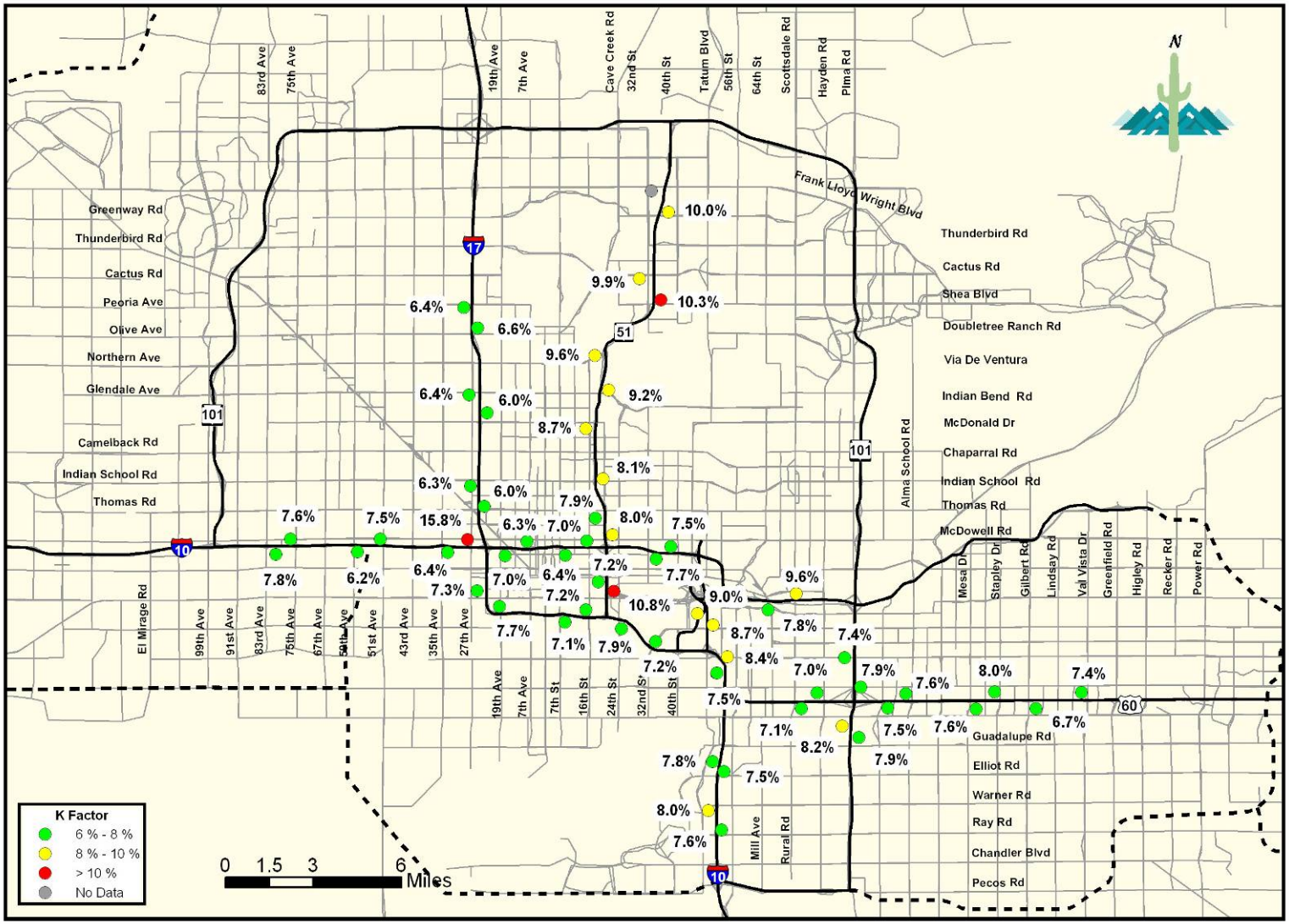

Figure 31. Percent of Daily Traffic Occurring in the Peak Hour (K-Factor), 2004

5. FINDINGS AND CONCLUSIONS

The preliminary findings and conclusions from analyses of 2004 at 58 locations in Phoenix are summarized below.

- **Most of the traffic trends and patterns within 2004 appear reasonable and consistent.** Previously, there has been apprehension about whether the quality of FMS data was adequate for historical analyses. The analysis of 2004 data found reasonably consistent traffic trends and patterns. Field validation of the traffic counts and speeds measured by the 58 TMS sensors is planned for later in 2005, and this activity should provide verification of the accuracy.

- **Several of the year-to-year trends from 2000 to 2004 are suspect.** Because numerous TMS sites did not produce data prior to 2003, many of the trend analyses only compared 2003 to 2004 data. Preliminary analyses of earlier data (not included in this report) did indicate some inconsistencies and drastic changes over this five-year period. Because of the uncertain data quality, caution should be used when using data prior to 2004.

- **Only a few locations did not have enough data to report any traffic trends for 2004.** The locations with insufficient data included 3 of the 6 freeway lanes at Station 73 (I-10 WB: W of 27th Ave), the inside freeway lane/HOV lane at Station 139 (I-10 WB: W of 16th St), and all 3 freeway lanes at Station 312 (SR 51 SB: S of Bell). Several other locations had entrance ramps with insufficient data (Stations 20, 68, 75, 64, 417, 411, 355, 303, 312).

- **Afternoon and evening congestion appear to be significantly worse than the morning congestion.** The longest duration of morning congestion is 1.5 hours, with most locations having less than 1 hour of congestion (defined as speeds less than 50 mph). The duration of congestion in the evening exceeds 3 hours in 2 locations, and another 2 locations have more than 2 hours. This finding is agrees with other congestion analyses in FHWA's Mobility Monitoring Program (http://mobility.tamu.edu/mmp).

- **The current data summaries provides significant insight into traffic flow patterns and, with more analyses, could be used to support traffic management and operations activities.** For example, the charts in the appendix could be used to determine which locations would be prime candidates for more aggressive ramp metering. Several of the map displays that show congestion duration could be used to identify and prioritize freeway bottleneck removal projects.

- **The concept of "lost capacity" and freeway operations efficiency should continue to be explored.** The analyses included in this report were cursory in nature. The methodology could potentially be refined, with further analyses considering other ways to communicate results.

- **This first annual report is only a "starting point" and represents a small fraction of the analyses possible given the available data.** The analyses and data summaries in this report represent the most common or most desired applications. There are many more analyses that could be performed with the available data. Subsequent annual

reports will likely evolve as common themes are retained and refined and additional topics are explored and added.

- **Future editions of this report should address changes in the roadway network (e.g., supply) as well as traffic improvement projects.** The current report prototype includes significant information about the previous year's performance as well as how this performance has improved or declined over the past few years. However, the report does not comprehensively address possible reasons for such performance improvements or declines. For example, Figure 8 does track system-wide traffic per lane-mile, but more detail would be necessary to see which locations in Phoenix have grown the most. Similarly, it would be desirable to know how performance has changed at locations where the road supply (lane-miles) or operational strategies (ramp metering, HOV lanes, etc.) has changed.